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SHOP AND DRAFTING-ROOM PRACTICE

Modern Methods Produce Washing Machine Parts — *By K. F. Livengood* — 137
Automatic Facing and Threading Machines Speed Pipe Production — *By Charles H. Wick* — 144
Making Lay-Out and Detail Drawings for Sectional Ground Dies — *By Cliff Bossmann* — 154
"Brain Block" Control of Standard Lathe Increases Output Seven Times — 158
Die Set-Up that Permits One Press to Handle Multiple Operations — 160
Liquid Blasting Cuts Cost of Reconditioning Die-Casting Dies — *By Albert G. Lintel* — 170
Reproducing Drawings to Meet Increased Production Demands — *By F. S. Dunham* — 175
Interchangeable Tooling Applicable to Wide Range of Work Sizes — 177

MACHINE AND TOOL DESIGN

Designing Hydraulic Cylinders for High Pressures — *By Woodrow L. Wroble* — 149
Design of Involute Gear Hobbing Cutters — *By F. G. Watts* — 165
Three-Speed Gear Conversion Unit for Bicycle Coaster Brake — 185
Jig for Rapid Accurate Drilling of Air-Valve Part — *By Robert W. Newton* — 188
Cam-Actuated Milling Fixture — *By Cliff Bossmann* — 189
Positive Ejector for Removing Embossed Part — *By F. A. Adams* — 189
Amount of Draft for Various Angles and Cavity Depths (Data Sheet) — 235
Standard Dimensions for Welded and Seamless Stainless-Steel Pipe (Data Sheet) — 235

MANAGEMENT PROBLEMS

The Nation Looks to Industry — *By Charles O. Herb* — 153
The Sales Engineer and His Problems — *By Bernard Lester* — 191

DEPARTMENTS

Engineering News — 162
Materials of Industry — 182
Questions and Answers — 184
Ingenious Mechanisms — 185
Tool Engineering Ideas — 188
The Sales Engineer — 191
Shop Equipment News — 193
Between Grinds — 227
News of Industry — 228
Data Sheet — 235

Product Index 319-353
Advertisers Index 355-356

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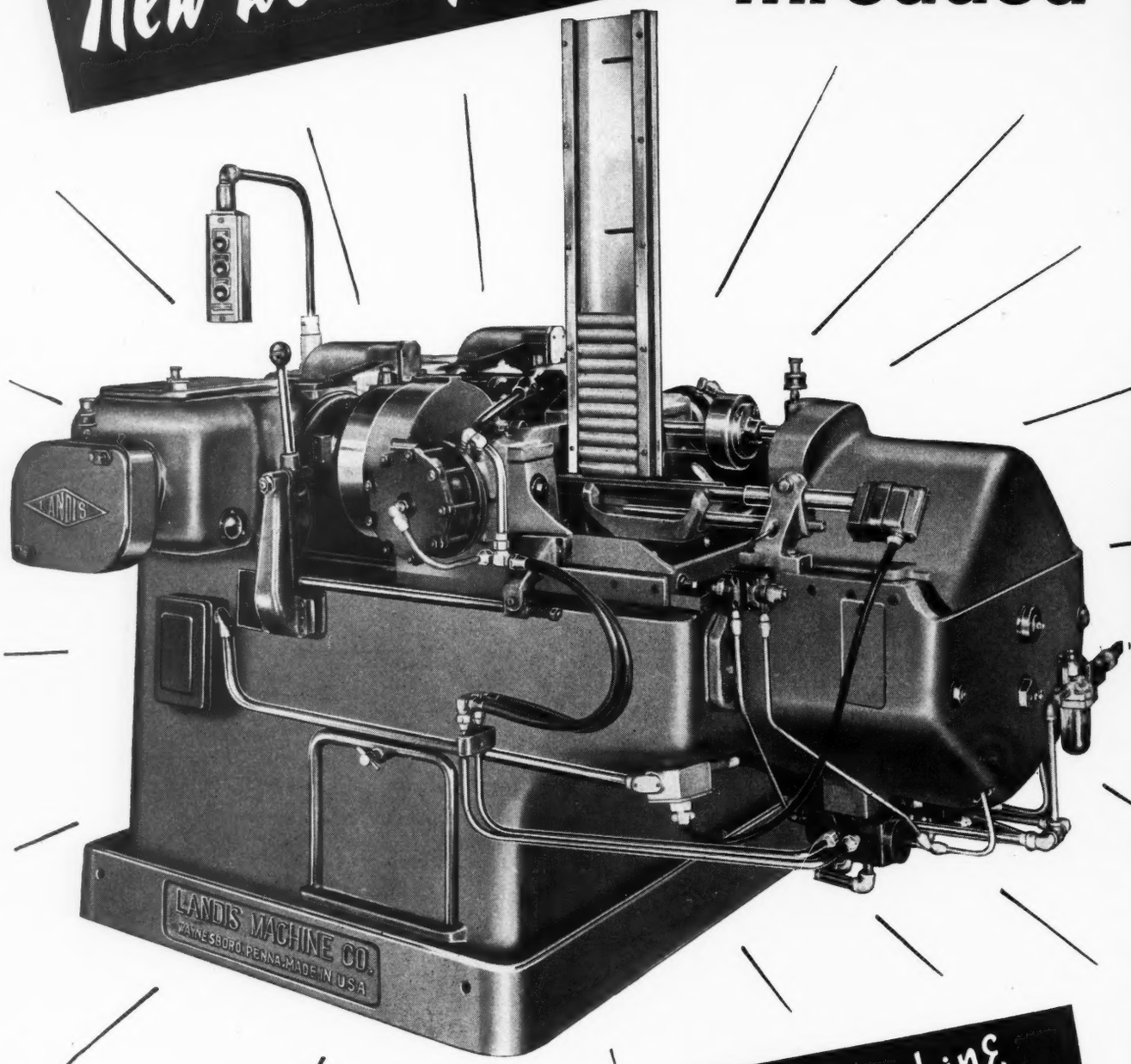

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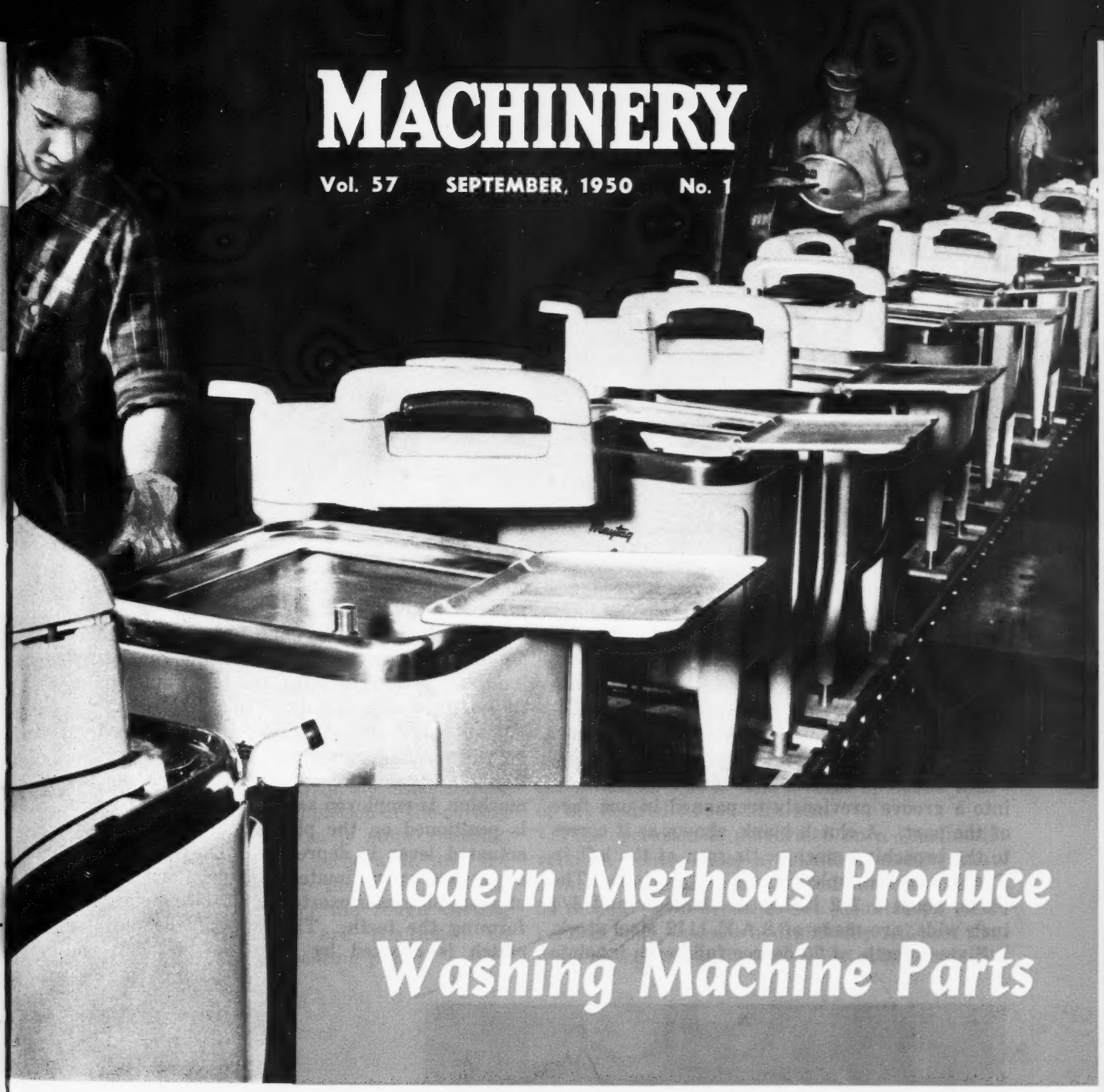


Modern Methods Produce Washing Machine Parts

Machining Methods Employed by the Maytag Co. Produce Various Parts for Washing Machines to Close Dimensional Accuracies without Sacrificing High Production Rates

By K. F. LIVENGOOD, Assistant Chief Tool Engineer
The Maytag Co., Newton, Iowa

MORE than 100,000 parts are machined each day in the two washing machine plants of the Maytag Co. Some precision parts require as many as twenty individual operations, and the high production rates obtained vary up to a maximum of 600 per hour. A comprehensive statistical quality control program has been instituted to insure dimensional accuracy of the parts. Quality control charts have been placed on each machine so that the individual operators can check their work. With this system, scrap has been reduced from 6 to 0.36 per cent in six months.

In the automatic screw machine department, an average of 14 1/2 tons of steel, aluminum, and brass bar stock, ranging from 1/16 to 3 1/2 inches in diameter, are machined each day on thirty-four machines. Close tolerances are main-

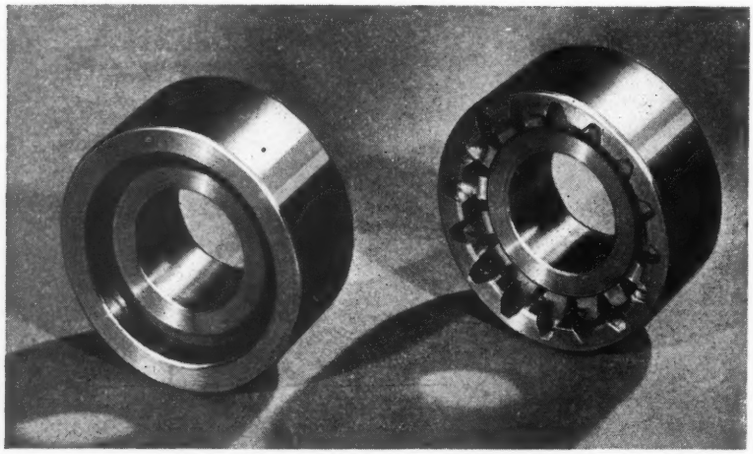


Fig. 1. Internal, blind gear teeth are formed in the face of agitator clutches by "broaching" in the set-up illustrated in Fig. 2

tained and finely finished parts are obtained from these machines by using dovetailed forming tools and shaving tools with roller back-up rests for supporting the stock during machining.

A unique operation employed in the production of agitator clutches is the so-called "broaching" of internal, blind gear teeth. The teeth are actually formed by displacing metal from between the teeth, the displaced metal being forced into a groove previously trepanned in one face of the part. A clutch blank, shown as it comes to the broaching machine, is seen at the left in Fig. 1, and a completed part at the right. The parts, about 1 1/2 inches in diameter and 3/4 inch wide, are made of S A E 1112 steel stock.

Sixteen teeth, of 20-degree full-depth involute design and 12 diametral pitch, are formed in the face of each clutch. Their pitch diameter, 1.3364 $\pm$ 0.0010 inch, must be concentric with the bore and periphery of the part within 0.004 inch total indicator readings. Also, the teeth must be of the required size to a depth of 0.125 inch.

The tooth-forming operation is performed on an Oilgear 50-ton, vertical broaching machine, Fig. 2. A pinion die, mounted on the ram of the machine, is employed as the "cutter." The part is positioned on the pilot fixture, and a foot-actuated lever is depressed. The ram travels downward approximately 3 inches, and a force of about 35 tons is exerted to displace metal, thus forming the teeth. The bore of the agitator clutch is checked by means of a "Go" and

Fig. 2. Teeth are formed in clutch face, Fig. 1, by forcing metal into a groove that has been previously machined in the part

"No Go" plug gage, the teeth by a pitch gage and flush-pin depth gage, and the periphery by a concentric gage. A production of 405 clutches per hour is obtained in this operation.

Die-cast S A E 308 aluminum-alloy brake-shoes are contour-milled and slotted at the rate of 145 per hour by means of the set-up seen in Fig. 3. As shown on the part drawing, Fig. 4, the periphery of the brake-shoe is held to ± 0.005 inch, and the slot width within ± 0.0025 inch. A standard Sundstrand Rigidmil with a special head is used for this operation. The special high-speed head is equipped with one vertical and one horizontal spindle. Each spindle is belt-driven from an independent motor, the horizontal spindle rotating at 1900 R.P.M. and the vertical spindle at 1200 R.P.M. Both spindles can be adjusted endwise, and the horizontal spindle automatically retracts at the completion of the cutting cycle.

The milling machine table is provided with two power-operated, rotary work-holding fixtures which are timed and interlocked with the automatic table cycle. The work is manually clamped, and one fixture is unloaded and reloaded while the part held in the other fixture is being milled. At the completion of the cutting cycle, the fixture automatically stops rotating, the horizontal spindle is withdrawn, and the table is rapidly shifted so that the completed part can be unloaded and the rough casting milled. The work-pieces are positioned on the fixture by means of locating pins.

A face mill 2 1/2 inches in diameter and having six carbide inserts is provided on the horizontal spindle for machining the periphery of the brake-shoe. The slotting cutter, mounted on the vertical spindle, is 3 inches in diameter and is also equipped with six carbide-tipped teeth. The complete machine cycle time, including 0.043 minute for rapid traverse, is 0.254 minute. The same machine is also used periodically for milling the cork face subsequently cemented to the peripheries of the brake-shoes. For this operation, the slotting cutter is removed from the vertical spindle.

The faces, slot, and rack teeth of a combination rack-and-slot casting are machined successively by means of the broaching set-up illustrated in Fig. 5. Cast-iron parts are shown before machining at the left in Fig. 6, and after broaching at the right. The twelve teeth on the rack are of 20-degree full-depth involute design and 12 diametral pitch. The pitch line of each tooth is maintained within ± 0.001 inch, and the teeth are held square with the slot and hole within 0.005 inch total indicator reading. The width of the broached slot is held within ± 0.0005 inch of the desired 0.9995 inch size.

This operation is performed on a Cincinnati vertical, double-slide, hydraulic broaching machine having a capacity of 5 tons and a stroke of 54 inches. Two broaches are mounted on each vertical slide, and are hydraulically fed past the work at the rate of 33 feet per minute. A swivel

Fig. 3. Set-up that is employed to contour-mill and slot die-cast aluminum-alloy brake-shoes at a production rate of 145 per hour

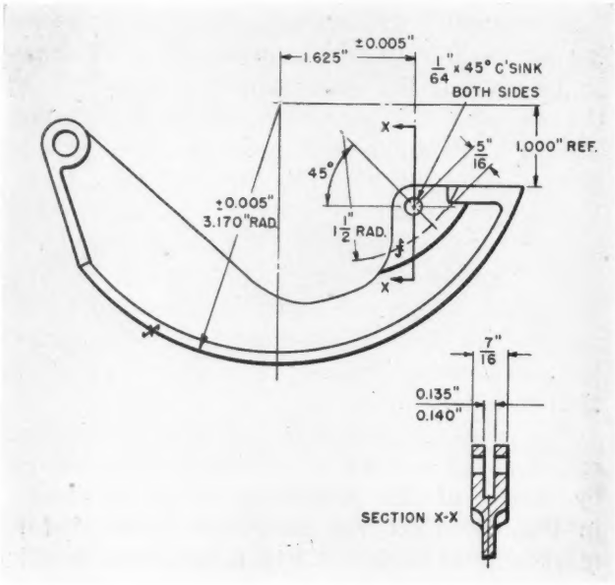


Fig. 4. Part drawing of the die-cast brake-shoe that is contour-milled and slotted by means of the set-up shown in Fig. 3

type table equipped with four work-holding fixtures is provided on the machine. When one pair of fixtures is swiveled into the machining position, the other pair is swung out into the loading and unloading position.

Each part is progressively moved from station to station, being manually clamped in the successive work-holding fixtures. The slot and flat faces on either side of the slot are completed at the first three stations, with stock removal from each surface averaging 1/32 inch. The rack teeth are broached at the fourth station, seen in the foreground of Fig. 5. Total machine cycle time, including indexing of the fixtures, is 0.388 minute, resulting in a net production of 100 parts per hour.

Tubs for the automatic washing machines are cast from S A E A-108 aluminum alloy in permanent molds. The large tubs measure approximately 21 3/8 inches in diameter and 11 23/32 inches high over-all. The average wall thickness is only 5/32 inch. Reaming, turning, counterboring, facing, and drilling and tapping of all the bottom holes in the tub are accomplished on the special W. F. & John Barnes horizontal duplex machine seen in Fig. 7. The machine is provided with a three-station, trunnion type fixture, and the operations are performed from both front and back simultaneously. Thirty-four horizontal spindles are provided on this machine. The trunnion fixture, equipped with three manually operated work-holding fixtures, is hydraulically indexed with a manually operated index-pin.

A sixteen-spindle multiple head is mounted on one hydraulically operated, self-contained, sliding head unit on the left-hand side of the machine, and a single-spindle head on a similar unit on the right-hand side. A special hydraulic unit

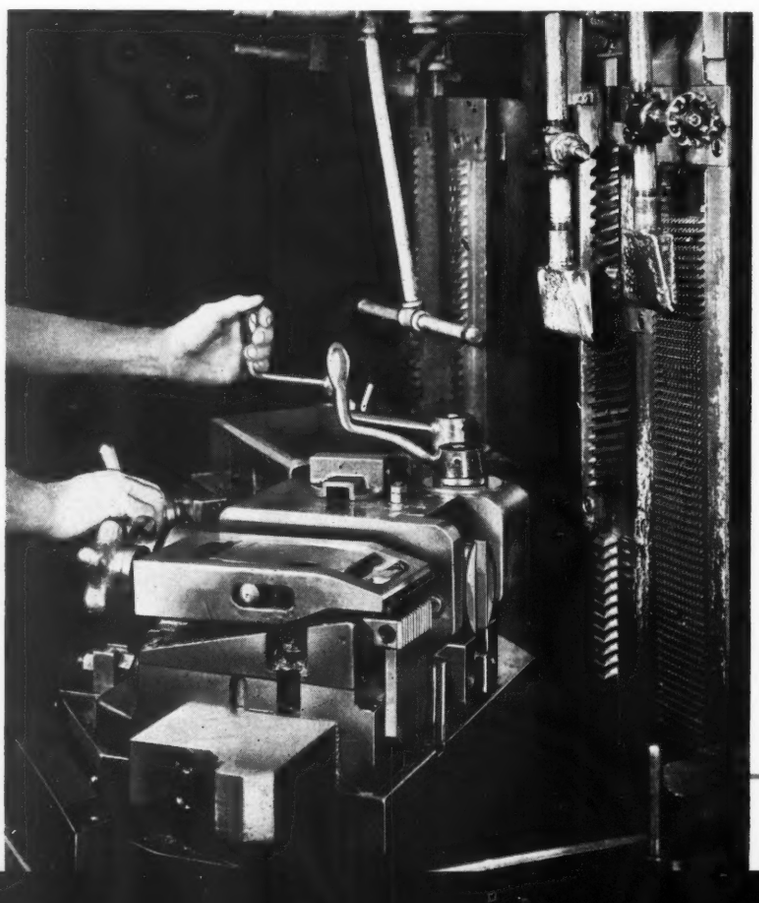


Fig. 5. Faces, slot, and rack teeth of a casting are successively machined on this 5-ton, double-slide, vertical broaching machine

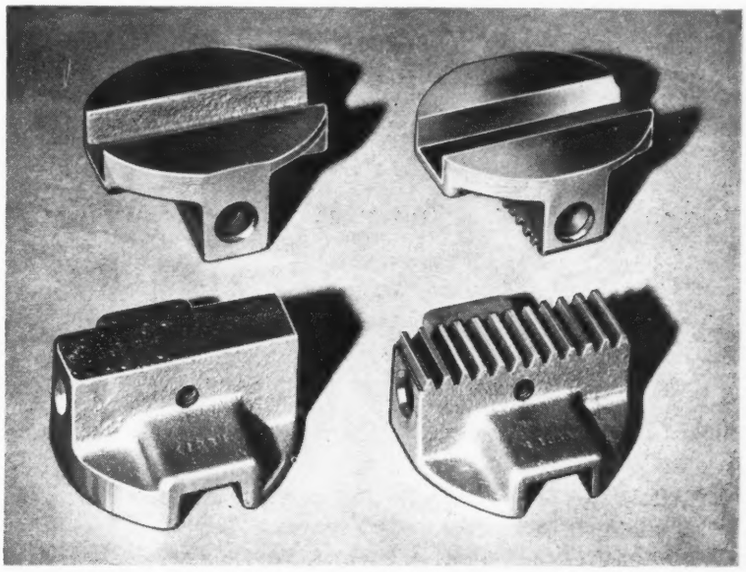


Fig. 6. Rough castings, seen at the left, are faced, slotted, and have the rack teeth cut in the broaching set-up shown in Fig. 5. Finished parts are seen at the right

actuates a two-spindle, quill type head and a single-spindle, dovetailed slide unit. Tapping is accomplished by means of a fourteen-spindle, individual lead-screw type head equipped with twelve tapping spindles and two free-wheeling reaming spindles.

The bottom of the tub and hardened locating buttons on the work-holding fixture are cleaned by a blast of compressed air before loading the part at the first station, seen at the left. A previously milled surface is used to locate the part against the buttons, and a spring-actuated plunger positions the part radially against a positive locator mounted at one end of a counterweight. A hand-rotated ratchet wheel actuates the three hook clamps which grip the upper edge of the tub and hold it during machining.

A stop-start push-button is then depressed to start the automatic cycle. The fixture is rotated through an angle of 180 degrees to place the unmachined part at the first station, seen at the upper right. Here ten holes are drilled for a 5/16–18 tap; two holes 0.309 inch in diameter are produced with sub-land drills; a 31/32-inch round hole is core-drilled; and two 5/16-inch diameter holes are drilled — all from the left-hand side of the machine. A carbide-tipped, pin-drive counterboring cutter and a special facing and counterboring cutter-head are mounted at the right in this station. The latter head is equipped with carbide-tipped tool bits for facing the 2-inch diameter hub, boring a hole 1.437 inches in diameter, and turning a surface 1.750 inches in diameter.

At the second station, two angular holes 1/4 inch in diameter are drilled 1 1/16 inches deep, and a hole 0.998 inch in diameter is bored. A special boring quill equipped with a 3/16-inch square carbide bit is employed for boring. When the part is returned to the third or loading and unloading station, spindles mounted on a horizontal-acting head at the rear of the machine are advanced to ream and tap holes in the bottom of the tub. Ten holes are threaded with 5/16–18 taps and two holes with 3/8–16 taps, while two dowel holes, 0.3095 inch in diameter, are reamed. The complete cycle time, including rapid approach, feed, rapid return, stopping, and indexing, is slightly less than one minute. The production is based on the slowest operation, which is boring the 0.998-inch diameter hole at a feed rate of 7.8 inches per minute, or 0.007 inch per revolution.

A difficult operation required on the long, slender center-drive tubing for the automatic washer is the turning, boring, and facing of both ends. One end of the part has to be precision-bored for the press-fit assembly of a bushing. The boring and turning operations are being quickly and accurately performed on the W. F. & John Barnes horizontal, double-end machine seen in Fig. 8. The machine is equipped with a head having two hollow spindles arranged to hold one part in each spindle. Air-operated collet chucks are provided at each end of the spindles, and a retractable stop is provided for endwise location of the parts. The center-drive tubing, made from AISI C-1144 steel, has an

Fig. 7. Three-station, trunnion type indexing machine for reaming, turning, counterboring, facing, drilling, and tapping washer tubs

over-all length of 15.159 inches and measures 1.255 inches in diameter.

With the center-drive tubing inserted in a hollow spindle, one end of the part is turned, bored, countersunk, and faced while the opposite end is bored, faced, and countersunk. The bored hole in which the bushing is to be pressed is machined to a diameter of from 0.8245 to 0.8260 inch and a depth of 1 1/2 inches in this operation. The opposite end of the part is rough-bored to an inside diameter of 0.781 inch and a depth of 6 11/32 inches. This first operation is completed in a total cycle time of about one minute, including the time required for the hydraulic rapid traverse of the tools to and from the work.

After pressing the Oilite bronze bushing into the bored hole by means of a Hannifin air press, the center-drive tubing is placed in the other hollow spindle of the double-end machine. In this second operation, the bushing is bored to a diameter of 0.6265 inch, and a 1/16-inch by 12-degree chamfer is machined on the outer edge of the part. The opposite end of the work is finish-bored to 0.825 inch and finish-turned to 0.9915 inch in diameter. Also, 1/32-inch by 45-degree chamfers are machined on the end and shoulder of the part. Tungsten-carbide tool bits are employed for all operations on this hydraulically fed machine. Coolant is forced under pressure through oil passages provided in the boring-bars. The work is revolved at approximately 250 surface feet per minute about the non-rotating cutting tools.

Gasket grooves of irregular contour are milled in the flanges of the washer tub gear housings by means of the special set-up shown in Fig. 9. Two gear housings are contour-milled at one time, the total machining cycle requiring 1.05 minutes to give a net production of about 100 parts per hour. A standard Kearney & Trecker No. 2 vertical milling machine, modified by the addition of two Ex-Cell-O high-speed, vertical-spindle heads, is employed for the operation. The gasket groove is 0.156 inch wide by 0.127 inch deep, and about 11 1/2 inches in length.

The die-cast, aluminum-alloy gear housings

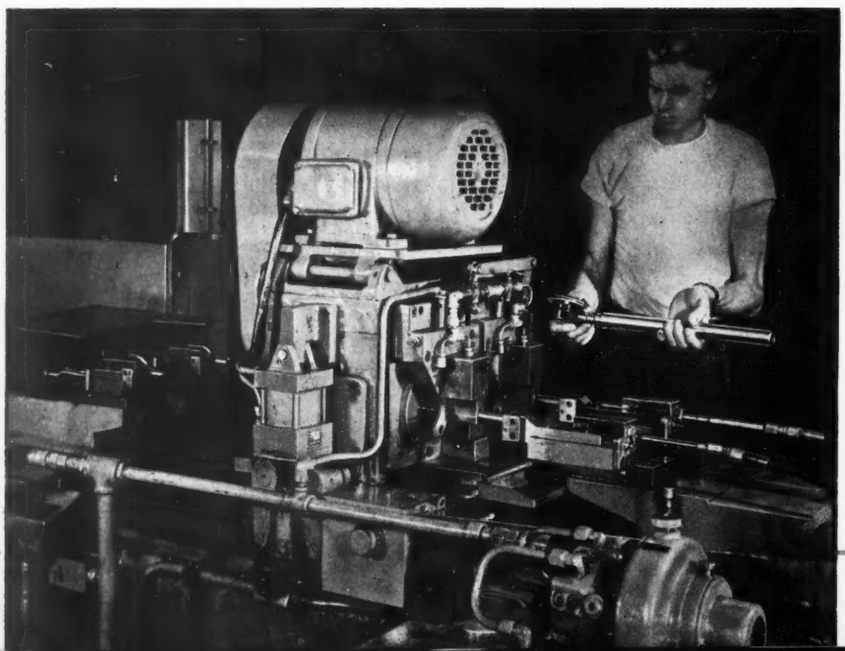


Fig. 8. Two-spindle, double-end machine for precision boring and turning both ends of the center-drive tubing for automatic washers

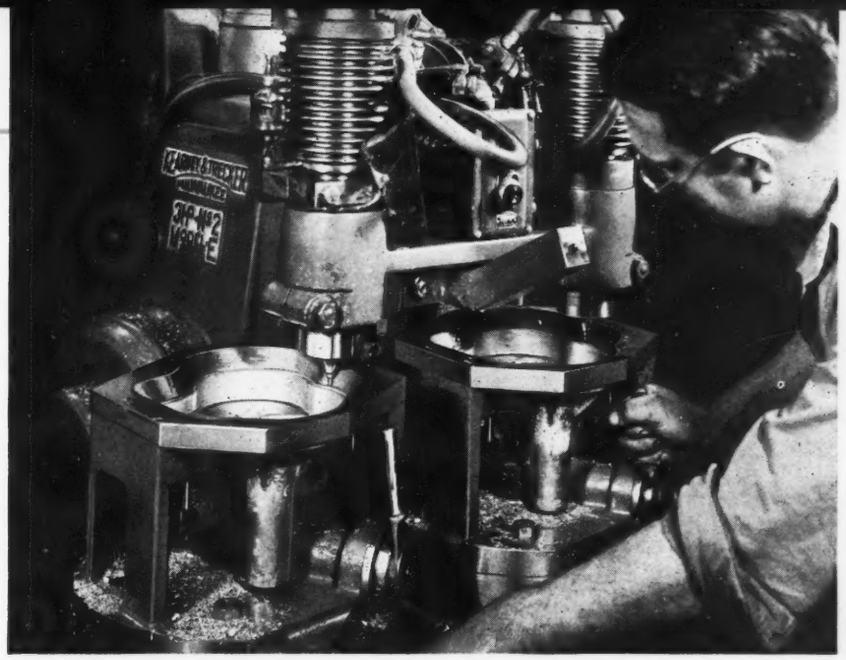


Fig. 9. Special high-speed spindles have been installed on this milling machine to contour-mill gasket grooves in aluminum castings

are slid into the front openings of the two work-holding fixtures, which are mounted on the table of the milling machine. Hand-lever actuated cams lift and clamp the work-pieces against the top locating plate on each fixture. The fixtures are rotated slowly, and the table is reciprocated by means of an air-loaded follower in contact with a rotating cam, so that the desired contour of the gasket grooves is automatically produced. Solid carbide, two-fluted end-mills are rotated at 10,300 R.P.M. in the special heads.

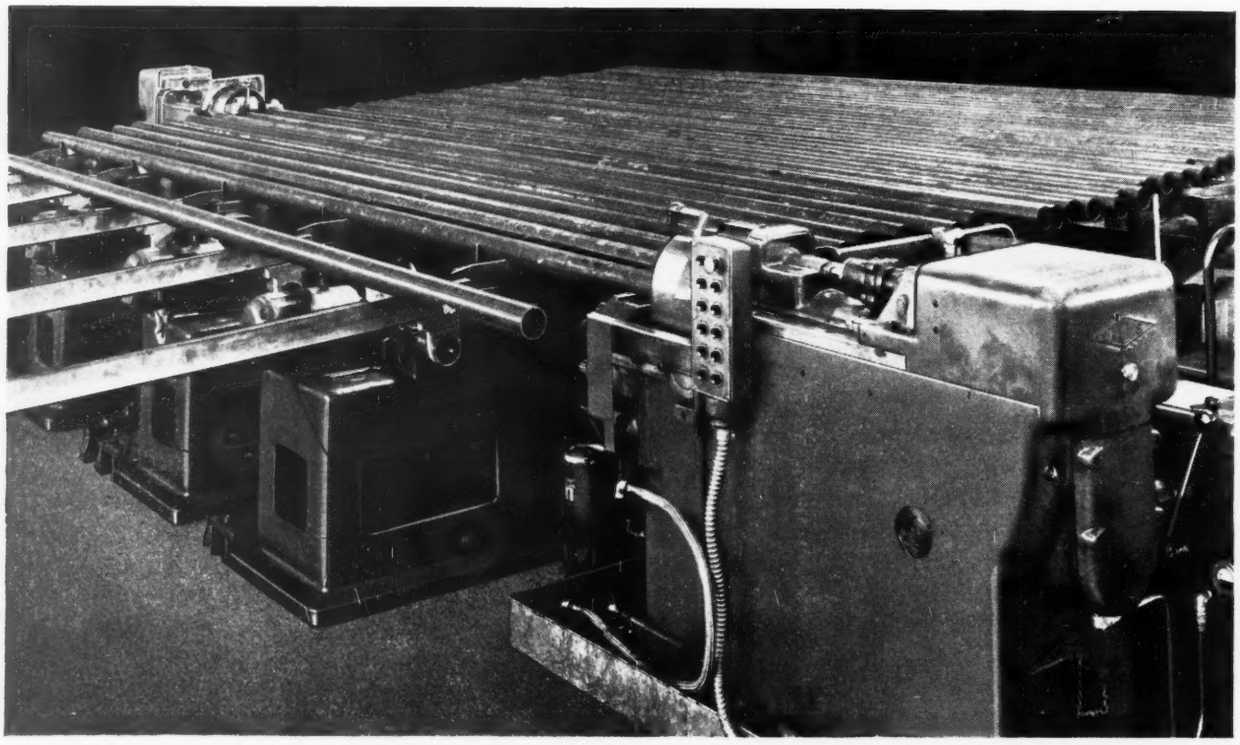
To insure quiet operation of the automatic washing machine, all the gears are finished to a high degree of precision by shaving. As far as is known, Maytag is the only washing machine manufacturer to shave the teeth of all gears. The involute form of the gear teeth is maintained within 0.0002 inch, pitch diameter within 0.001 inch, and run-out within 0.0005 inch. Such precision results not only in quiet washer operation, but also in longer gear life.

An unusual feature of the shaving operation, Fig. 10, is that gears of different materials are finished on the same machine without changing the tooling or cycle time. Two "underpass" type, rotary gear finishers, made by the Michigan Tool Co., are employed to shave the gears. Since the current productive requirements for each type of gear do not require the maximum output possible from each machine, one machine is used to finish two mating gears. One of these gears is a pitman-drive, gray-iron casting, and the other a malleable iron intermediate gear, both having a pitch diameter of 4.5 inches. The second machine shaves both Formica and steel gears having a pitch diameter of 1.333 inches.

The cycle time for each machine is set for the gear requiring the longest finishing time, and the same cycle is used for both gears. Even though one gear could be shaved in less time, the necessity of resetting the machine is avoided with this method. Each gear is completely shaved with a single backward and forward movement of the cutter, which rotates in mesh with the gear being shaved. The cutting time is less than 1/2 minute per gear on all types.

Fig. 10. Both gray- and malleable-iron cast gears are shaved on the machine at the left, and Formica and steel gears on the one at the right

Automatic Facing and Threading



PIPE production facilities at the Youngstown, Ohio, plant of the Republic Steel Corporation have been considerably improved by the installation of unique and completely automatic equipment for reaming, facing, chamfering, and threading both ends of a pipe at high production rates. Each unit, made by the Landis Machine Co., Waynesboro, Pa., consists of an automatic work-handling table and two machines, one machine being located at each side of the table, as seen in the heading illustration. This arrangement permits machining both ends of a length of pipe without the necessity of turning it end for end.

The automatic work-handling table transfers each pipe from one machine to the other, and also positions it to permit the progressive machining of each end. Smooth threads are generated at unusually high cutting speeds by the combination of an automatic, hydraulically actuated lead-screw mechanism and the receding action of the die-head chasers.

Two different types of units are employed—one a so-called "plain-ending" unit for reaming, facing, and chamfering both ends of each pipe, and the other a threading unit. One automatic threading unit, consisting of a transfer table and two machines, is capable of threading both ends of 750 lengths of 1/2-inch pipe per hour. The output, of course, varies with the pipe diameter, thread pitch, and length of thread. Since the plain-ending units have about twice the productive capacity of the threading units (being capable of automatically reaming, facing, and chamfering 1500 pieces of 1/2-inch pipe per hour), two threading units are required to handle the production obtained from one plain-ending unit. Only one man is needed for loading each unit, and no operators are required for the machines.

Six of these Landis automatic tube mill units are installed in the Republic plant. One plain-ending unit and two threading units have a capacity of from 1/2- to 3-inch pipe, while the other plain-ending unit and the two remaining threading units handle pipe sizes from 1 1/4 to 5 inches. American Standard taper pipe threads of 8, 11 1/2, or 14 pitch can be produced on any of the four threading units. The units are extremely flexible and permit quick set-up changes. Plain-ending units can be changed from the production of one size of pipe to another in one hour or less, while the threading units require approximately 1 1/4 hours for a complete set-up

Machines Speed Pipe Production

Smooth Threads are Automatically Generated on Both Ends of Pipes at Unusually High Speeds by Means of Unique Machines Employed at the Youngstown, Ohio, Plant of the Republic Steel Corporation. One Machine Automatically Threads Both Ends of 750 Lengths of 1/2-Inch Pipe per Hour

By CHARLES H. WICK

change from one pitch thread to another. The six automatic tube mill units represent a potential productive capacity of 16,000 tons of pipe per month.

Pipe faced and threaded on this automatic equipment is formed from Bessemer or open hearth, flat-rolled strip stock by the continuous welding process. Ends of the strip stock coils are joined together by electric resistance welding to form a continuous strip, which is fed through a long gas-fired furnace to heat it to the welding temperature. The strip is drawn from the furnace through a series of forming rolls, which progressively bend it to tubular form and bring the edges together with sufficient pressure to weld them.

When the pipes have been cut to length and straightened, they are loaded on a sloping rack at the entry end of the transfer table on the plain-ending unit. Transfer of the pipes from station to station is accomplished with a series of roller conveyor chains, one of which can be seen at *A* in Fig. 1, which have an electrically controlled, hydraulically operated indexing movement. The chains are built into the transfer table and have dogs *B* projecting upward from the table. Each length of pipe is picked up individually by the chains and rolled along the table from station to station at pre-set time intervals.

At the station immediately preceding the first machining operation, cam-bars fitted into the conveyor chain housings lower the pipe into contact with a series of motor-driven positioning grooved rollers *C*. These grooved rollers, which rotate continuously and handle pipe of any diameter within the capacity of the unit without adjustment, move the pipe endwise against stop *D*. The cam-bars then raise the pipe out of contact with the positioning grooved rollers so that it can be transferred to the machining station on the next indexing movement of the conveyor chains. Insert blocks to suit the pipe diameter are placed in the cam-bar assembly at the machining station to insure alignment of the pipe with relation to the machine head. In changing the transfer-table set-up to accommodate a dif-

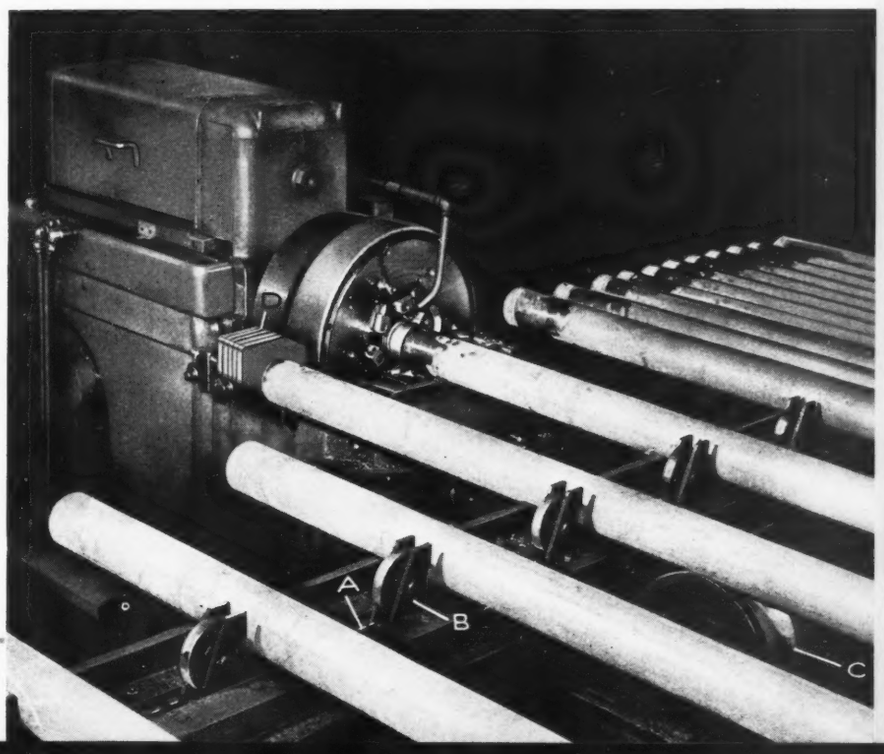


Fig. 1. Pipes are transferred from station to station by a series of roller conveyor chains (A). Grooved rollers (C) position the pipe endwise against stop (D)

ferent size pipe, it is simply necessary to substitute the proper insert blocks in the cam-bar.

Two hydraulically actuated work-clamping jaws are provided at the front of each machine, Fig. 2, to securely hold the pipe while it is being machined. The carriage of each machine on the plain-ending unit carries a rotating cutter-head which is hydraulically advanced to the pipe for the reaming, facing, and chamfering operations. As can be seen at the left in Fig. 3, the Lanco cutter-head contains a centrally located flat reaming tool and four tangential type tools which face and chamfer the pipe end. All of the tools are of 18-4-1 tungsten high-speed steel, and the heads are rotated to produce cutting speeds up to 90 feet per minute.

At the completion of the machining operation, the tools and carriage are automatically withdrawn, and the chuck opens. In opening, the chuck jaws enter the base of the machine, thus dropping below the level at which the pipes travel and permitting the pipe to be transferred to the next station for machining the other end of the pipe. Several idle stations are provided on the transfer table between the two machining stations. Grooved rollers are provided at these idle stations for transferring the pipe endwise to the opposite side of the table. This design permits handling pipe of varying lengths up to 55 feet.

After the pipe has been repositioned to the opposite side of the transfer table, and the other end has been reamed, faced, and chamfered, it is automatically discharged onto an unloading rack. Since unmachined pipes are placed continuously on the loading rack of the plain-ending unit under ordinary production conditions, one completed length of pipe is discharged with each indexing movement of the conveyor chains.

Pipes to be threaded are carried by means of an overhead crane to the loading end of the transfer table on one of the automatic threading units. The indexing and positioning functions on the threading units operate the same as on the plain-ending units. However, the machines provided on the threading units differ. On these machines, full receding chaser die-heads are employed to generate American, Whitworth, and other standard pipe threads. An electrically controlled, hydraulically engaged lead-screw mechanism is provided to feed the die-head at a fixed rate onto the pipe after the head has been rapidly advanced to the pipe. The threading units are arranged to handle pipes up to 25 feet in length, since the longer lengths of pipe seldom require threading.

Tangential pipe chasers are employed on the Lanco receding type, revolving die-heads, four chasers being held on the die-heads of the smaller capacity machines (seen at the right in Fig. 3) and six on the die-heads of the larger machines. The tangential cutting action of the chasers minimizes wear by allowing lateral absorption of the

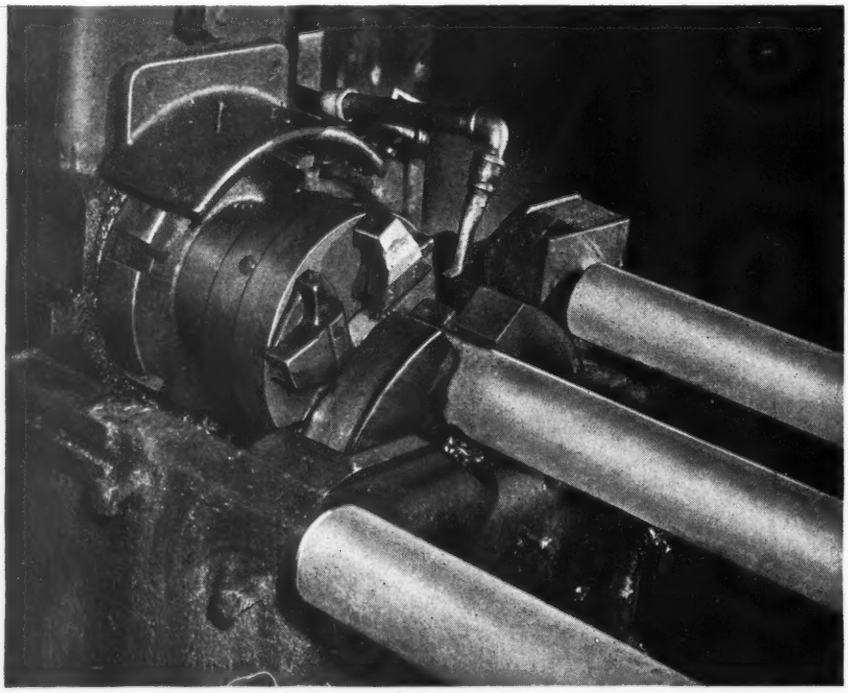


Fig. 2. A pipe is securely held by two hydraulically actuated work-clamping jaws while it is being reamed, faced, and chamfered by tools mounted on the rotating cutter-head

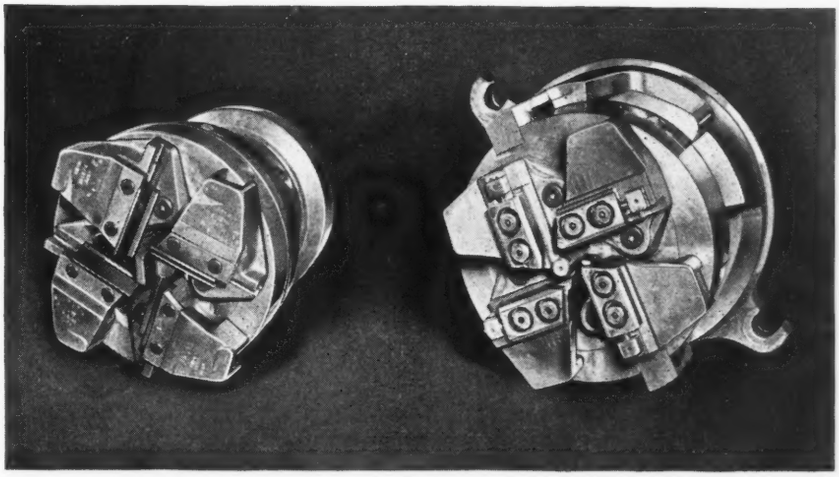


Fig. 3. Machines on the automatic plain-ending units are each equipped with a cutter-head such as seen at left, while the automatic threading unit machines are provided with die-heads like the one shown at right

cutting strain, reducing vibration and friction, and permitting the use of high cutting speeds without distorting the threads or breaking the chasers. The average cutting speed employed is 55 surface feet per minute, but surface speeds up to 90 feet per minute have been used with a corresponding decrease in the number of threads that can be cut before the chasers must be reground. Normally, the life of the chasers between grinds is about eight hours, or approximately 6000 threads on the smaller size pipe.

The chasers are made from 18-4-1 tungsten high-speed steel, heat-treated to a hardness of 60 Rockwell C and ground. Regrinding or sharpening is a relatively simple operation, which restores the entire cutting edge of the chaser while retaining the initial accuracy of pitch, diameter, and depth of cut. The same amount of metal need not be removed from each chaser, nor is it necessary to renew the throat angle in regrinding. The lead and rake angles are the only two angles involved in the grinding operation. The lead angle, or angle made by the cutting edge of the chaser with relation to the center line of the pipe being threaded, varies from 89 to 90 degrees with the pitch of the thread. A positive rake angle of from 22 to 24 degrees is employed, the larger angles being used to cut softer steels. A vitrified bond, aluminum-oxide abrasive wheel, of 46 or 60 grain size and L to N grade, has proved satisfactory for sharpening the chasers.

The chasers can be successively reground until more than 80 per cent of their original length has been used. Back-up plates, increasing in length as the chaser is shortened by grinding, are mounted behind the chasers in the die-head holders. The chasers are interchangeable, and can be replaced singly, as needed, without affecting the remaining chasers in the set. Chasers need not be changed to accommodate different size pipe within the capacity of the machine, unless a different pitch thread is desired.

With these receding type die-heads, accurate and uniform taper of the pipe thread over its entire length is insured by means of a sine-bar mechanism, which causes the chaser to be withdrawn at a rate equal to the taper desired on the thread. Simple, quick adjustments of the die-head can be made in changing from one pipe size to another. Different lengths of pipe having the same diameter can be handled without any change in set-up. Changes in the threaded length on similar size pipes require only about five minutes, while a complete change in pipe diameter, thread pitch, and length of thread can be set up in about 1 1/4 hours. Such short set-up times permit the economical production of small lots of various size pipes having different threads.

The hydraulically actuated cam mechanism employed for gripping the pipe on the threading machines has a full floating action. The gripping jaws open and close about an axis parallel to the center line of the pipe, thus insuring that the pipe is properly centered regardless of normal variations in the diameter of the pipe. In order to maintain the desired concentricity of thread, a centering pilot is located in the die-head bore to insure that the floating chuck and pipe are properly aligned with the die-head. Fig. 4 is a close-up view of one of the threading machines on these automatic units. An active sulphurized mineral oil is employed as a cutting fluid for the threading operation.

The combination hydraulic-electric circuit employed on each of the automatic tube mill units controls and interconnects the movements of the

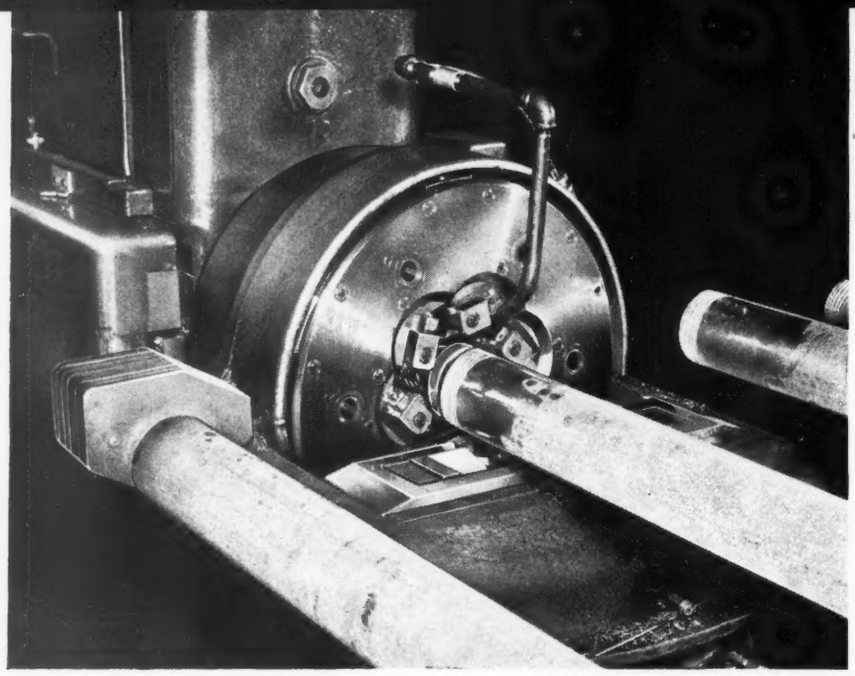


Fig. 4. Close-up view of one of the automatic threading machines. Tangential pipe chasers are employed on receding type, revolving die-heads. A centering pilot insures alignment of the pipe with the die-head

machines as well as the transfer table. The sequence type operating cycle is fully automatic and continuous. Each succeeding portion of the cycle must be completed in sequence before the following portion can be started. With this set-up, the entire unit will stop in the event that anything interferes with its normal operation. Each unit has its own electrical control panel, and each of the two machines in a unit has a separate hydraulic control panel.

Hydraulic pumps, which are attached to the machine driving motors, are connected in parallel so that they can supply either a large volume of oil (under a pressure of 400 pounds per square inch) to any of the operating cylinders in use, or a small volume of oil (under a pressure of 900 pounds per square inch) to the chuck-actuating cylinder. In the latter case, a large volume of the oil is by-passed while the machining operations are in process. Settings of the pressure-reducing valves can be varied to suit the required chuck gripping pressure. Separate motors are not required to drive the pumps because there is little demand for hydraulic power during machining. Electrical relays and limit switches control the solenoid-operated hydraulic valves which direct the flow of oil to the various operating cylinders.

When the start-cycle button is depressed, solenoid coils are energized, thus operating hydraulic valves which direct oil under pressure to the indexing cylinders. The pistons in the indexing cylinders, at the end of their strokes, actuate limit switches which cause solenoid-operated hydraulic valves to direct high-pressure oil to the chuck-actuating cylinders. Other limit switches, tripped by the chuck-actuating pistons at the end of their strokes, energize solenoid coils which operate valves directing oil to the die-head carriage cylinder.

Hydraulic advance of the die-head carriage toward the pipe to be threaded is halted by limit switches with approximately 1/8 inch clearance between the end of the pipe and the chaser throat. These switches cause solenoid-operated hydraulic valves to direct oil to the cylinders which engage the lead-screw nuts with the lead-screws, thus feeding the die-head mechanically at a fixed rate onto the pipe. When the advancing die-head yokes strike stops that have been pre-set for the desired length of thread, the die-heads snap open under spring action. This action trips another limit switch, which causes the nuts to hydraulically disengage from the lead-screws. The die-head carriage is rapidly returned, hydraulically, and the chucks are caused to open. Toward the end of their opening movement, the chuck jaws trip limit switches which actuate the indexing cylinders, and the cycle is repeated.

When the stop-cycle button is depressed, the controls can be changed from automatic to hand operation. In this way, the chucks can be independently operated, and the carriage hydraulically advanced or returned to facilitate set-up. A range of nine spindle speeds is available on each machine.

Designing Hydraulic Cylinders for High Pressures

Comparison of Cylinder Seals Used for Various Pressures and Outline of a Method for Applying Simple Formulas and New Sealing Principles to High-Pressure Cylinder Designs

By WOODROW L. WROBLE, Chief Engineer
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IN hydraulic presses and other hydraulically actuated machinery, a wide range of fluid pressures is used to actuate the power cylinders. The design of a hydraulic cylinder to meet some particular requirement is in part influenced by the hydraulic pressure available for its operation. For this reason, it is advantageous to classify cylinder designs as low, medium, and high pressure, each category having its own practice-proven design characteristics.

In the paragraphs that follow, some of the distinguishing features of each type of cylinder will be discussed, and in particular, a new high-pressure design having minimum fluid loss by leakage.

Low-Pressure and Medium-Pressure Cylinders

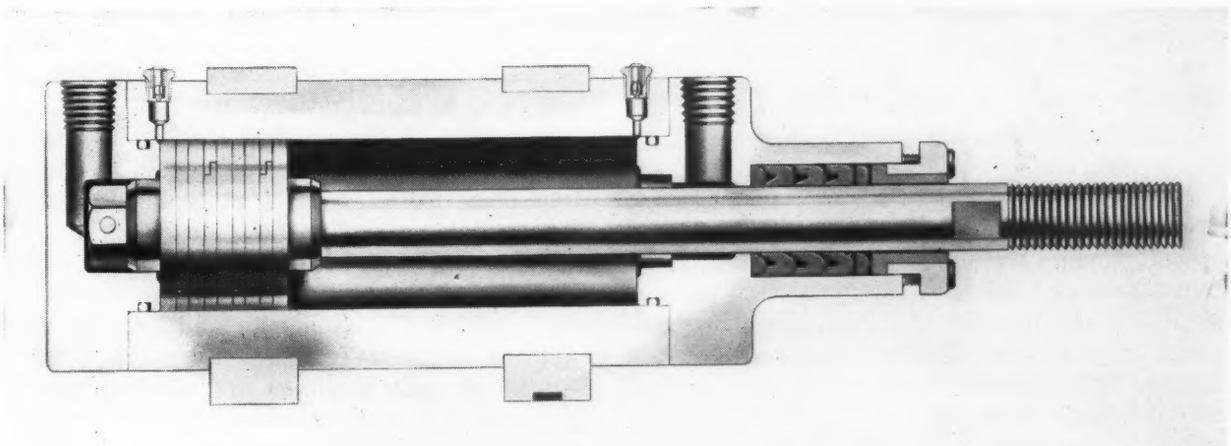
An example of a low-pressure cylinder designed by the Hydro-Line Mfg. Co., Rockford, Ill., is shown in Fig. 1. The cylinder body is centrifugally cast, precision-bored, and honed to close tolerances. The end caps are of cast steel, and are bolted to the cylinder by hardened socket-head cap-screws. The piston is cast iron, fitted with automotive type, cast-iron piston-rings. To reduce packing wear, the piston-rod is ground and polished to a finish of 15 micro-inches r.m.s.

Fluid leakage is prevented by three seal ring packings, in addition to a header and follower. "O" rings are used in each end cap as further assurance against leakage. Manually operated air vents are used to bleed off entrapped air. Considerable development work has been done on low-pressure cylinders which, in most cases, use cast-iron piston-rings or "O" rings as pressure seals.

There are commercially available low-pressure cylinders in a variety of diameters and stroke lengths, with various mounting provisions and piston-rod attachments.

Medium-pressure cylinder designs require

Fig. 1. Typical low-pressure hydraulic cylinder for pressures up to 1500 pounds per square inch



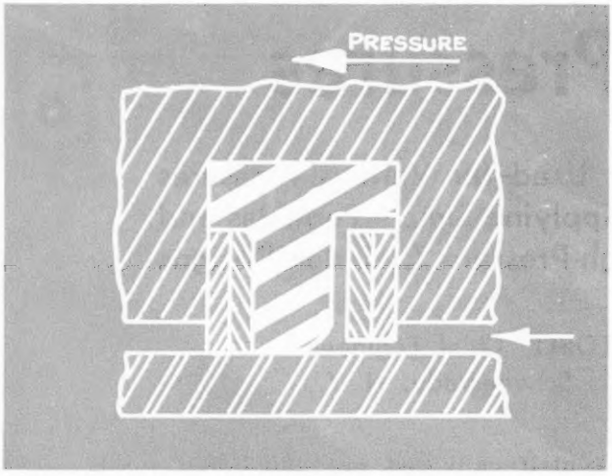


Fig. 2. Sealing action of the G-T ring type of packing under full pressure

more effective packing to prevent fluid leakage. Leakage past the piston and piston-rod is prevented in some designs by Palmetto G-T ring packing. This packing, Fig. 2, is designed to eliminate extrusion of the packing material into the clearance space between rubbing parts. It consists of a T-section sealing ring of synthetic rubber, backed up on each side by two laminated phenolic split rings. Fluid pressure compresses the T-section, forcing it against the cylinder wall. The T-section, in turn, presses the split rings against the low-pressure side of the piston and down against the cylinder wall, insuring against leakage.

Other medium-pressure designs using standard leather packing are commercially available for pressures up to 5000 pounds per square inch, but the superior design, simpler installation, and useful temperature range (—70 to + 250 degrees F.) of the sealing ring described offers advantages not found in conventional leather packing.

High-Pressure Cylinders Operating at 5000 to 10,000 Pounds per Square Inch

High-pressure cylinders are not commercially available, but are specially designed to customer specifications. Many high-pressure cylinders in commercial use are slow acting, bulky in construction, and objectionably leaky, requiring frequent maintenance. To meet the need for fast acting, high-pressure cylinders for use in special hydraulic machinery and presses, the cylinder shown in Fig. 3 was invented.

All-welded steel construction of this cylinder provides a design that is small and light in weight relative to the power it transmits. The end head is welded to a seamless steel mechanical tube having a safe working stress of 20,000 pounds per square inch. A heavy flange is welded to the other end for bolting to the platen of a Wroble high-speed hydraulic press. The cylinder is double acting, and in the Wroble press, is powered by a 10,000 pounds per square inch Simplex radial piston hydraulic pump.

The prominent aspect of the design is that it does not use soft packing to seal the moving parts. The piston has cast-iron piston rings for sealing off pressures up to 2000 pounds per square inch. Above this, the annular lips of the piston proper expand and provide a seal for pressures from 2000 to 10,000 pounds per square inch.

The rod is sealed in a similar manner using contracting piston-rings to seal the rod to 1500 pounds per square inch, while above this pressure the contraction of an inserted annular lip in the head end seals the rod. Between the contracting rings, a groove in the gland head collects leaked oil, which is returned to the oil reservoir.

The gland head is sealed by a conventional "O" ring. The piston and the annular contracting lip of the gland head are made of specially heat-treated tool steel, and are precision-ground to close tolerances. The cast-iron piston rings are of step seal design, which has proved satisfactory for hydraulic cylinder use. The cast-iron rings reduce the sliding friction at low pressures where steel-to-steel contact is avoided.

In place of cast-iron rings, the previously described G-T packings can be used. When this type packing is employed, the annular lips are so designed that they begin to seal above 5000 pounds per square inch. In many applications, this packing, in combination with the annular steel lips, is more satisfactory than cast-iron rings used with the annular steel lips, since it gives a higher mechanical efficiency by eliminating steel-to-steel contact at pressures under 5000 pounds per square inch.

A Wroble 70-ton, 10-inch stroke, 10,000 pounds per square inch, high-pressure hydraulic cylinder with a cast-iron piston ring and annular steel lip combination weighs less than 125 pounds. Because no soft packings are used, it can be utilized over a wide temperature and pressure range.

High-Pressure Cylinder Strength Considerations

Knowing such performance requirements as stroke length, capacity, and available fluid pressure, calculations can be made for wall thickness and cylinder diameter. The inside diameter of the cylinder is found by the following formula:

$$D = 2\sqrt{\frac{2000\,T}{\pi P}} = 50.5\sqrt{\frac{T}{P}} \qquad (1)$$

where D = inside diameter of cylinder, in inches;
T = load on piston, in tons; and
P = available fluid pressure, in pounds per square inch.

The wall thickness t, in inches, is determined by using Lamé's equation for cylinders subject to internal pressure:

$$t = \frac{D}{2}\left(\sqrt{\frac{S+P}{S-P}} - 1\right) \qquad (2)$$

where D = value determined by Equation (1); and
S = allowable working stress of cylinder material, in pounds per square inch (see MACHINERY'S HANDBOOK, Fourteenth Edition, page 416).

Some designers prefer to use Equation (2) for brittle material only, such as cast iron, and to apply Clavarino's equation, which is given in the following, to cylinder designs that employ ductile materials, as, for example, steel:

$$t = \frac{D}{2}\left(\sqrt{\frac{S+P\,(1-2M)}{S-P\,(1+M)}} - 1\right) \qquad (3)$$

where M is Poisson's ratio, which is equal to 0.30 for steel and 0.35 for brass.

The thickness of cylinder bottoms T, in inches, is determined by the following formulas:

$$T = 0.405D\sqrt{\frac{P}{S_p}} \text{ for flat bottoms} \qquad (4)$$

$$T = \frac{PD}{4S_p} \text{ for spherical bottoms} \qquad (5)$$

where S_p = allowable working stress of the material used, in pounds per square inch.

The load L to which the gland-head bolts are subjected is:

$$L = \frac{\pi P}{4}(B^2 - d^2) \qquad (6)$$

where B = bolt circle diameter, in inches; and
d = piston-rod diameter, in inches.

The number of bolts N required to hold the gland head in place against the fluid pressure is:

$$N = \frac{L}{AS_B} \qquad (7)$$

where A = minor area of bolt used, in square inches (see MACHINERY'S HANDBOOK, Fourteenth Edition, page 987); and
S_B = allowable working stress of bolt material, in pounds per square inch.

The expansion Z of the annular lips for zero

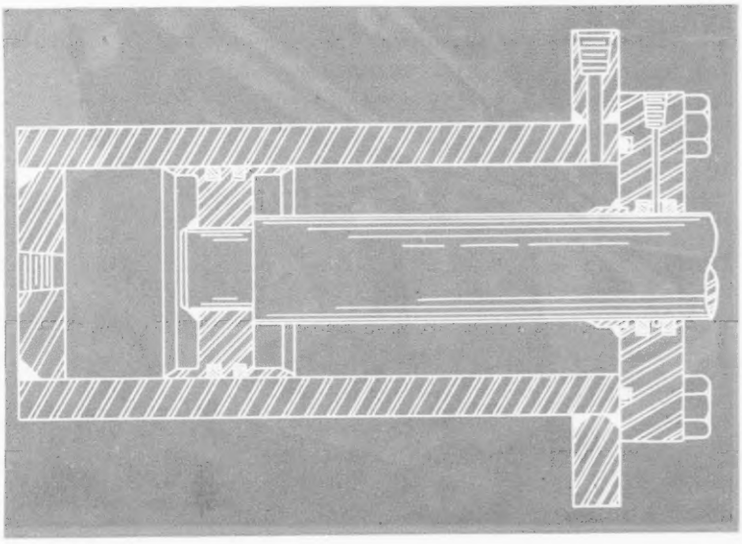


Fig. 3. Wroble high-pressure hydraulic cylinder with expanding annular piston lips

clearance at any predetermined pressure is found by the following formula:

$$Z = \frac{R}{E}(S_2 - MS_1) \qquad (8)$$

in which

$$S_1 = \frac{PR}{2t}$$

$$S_2 = \frac{PR}{t}$$

In the foregoing formulas,

S_1 = longitudinal cylinder stress, in pounds per square inch;

S_2 = hoop cylinder stress, in pounds per square inch;

Z = radial displacement, in inches;

E = modulus of elasticity, in pounds per square inch, which is equal to 30,000,000 for steel;

M = Poisson's ratio; and

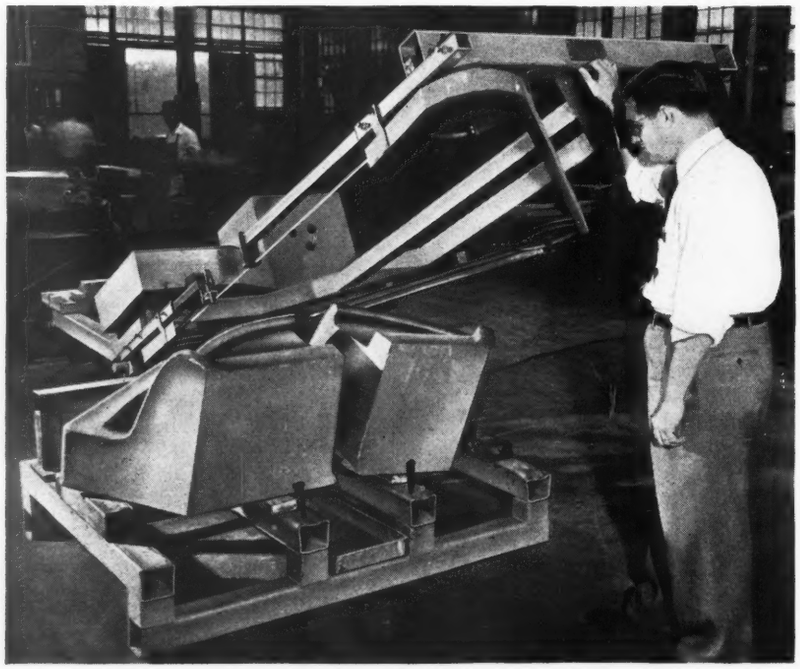
R = mean radius of cylinder, in inches.

Special Saw Designed to Cut Apart Large Dies

THE problem of melting obsolete drop-hammer dies too large to be placed in a furnace has been solved at the plant of the Glenn L. Martin Co. in Baltimore, Md., by the use of a special saw developed by Jay M. Boyd, Jr. The deep-throated saw, shown in the accompanying illustration, is designed on the band-saw principle. Large dies weighing approximately 5 tons have been sawed in two in fifty-five minutes with this machine. Various types of drop-hammer die material can be cut.

Only one unskilled operator is required, and there is no danger in operating the saw. A counterbalance is provided, so that the saw can be raised and lowered easily about its pivot point. The saw is also portable, so that it can be located in various parts of the plant.

Before the development of this saw, dies that were too large to fit in the furnaces were sometimes burned in half. In other instances, the dies were sheared on a hydraulic press. When large dies were burned, it usually required from six to eight hours, and the shearing of large sized dies took about four hours.



Special deep-throated, tilting type band saw developed for quickly sawing apart obsolete drop-hammer dies that are too large to be put in a furnace

The Nation Looks to Industry

WHENEVER our country becomes involved in a war or a near war, the cry goes out to industry to provide the means for averting national disaster. For it is only with the full cooperation of industry that our fighting men can be supplied with the equipment to combat an enemy successfully. Aircraft, ships, tanks, guns, and munitions can be turned out only by using the facilities that industry has built up mainly in the production of peacetime goods.

All talk about the dissolution of big business concerns has disappeared for the time being, because even politicians recognize the fact that the biggest companies can help the country the most in time of war. In World War II, one hundred corporations handled over 67 per cent of the total value of defense contracts. In fact, ten concerns handled over 30 per cent of the contracts, producing materiel having a value of $53,000,000,000.

Instead of deriding "big business" as has been done during the past few years, government agencies are now releasing such news as the fact that the du Pont company has agreed to carry on the development of the hydrogen bomb—a job that may take years—for a fee of but $1! Only a prosperous company could afford to undertake such an enterprise.

Yes, the cry today is for full cooperation of business, and industry is anxious to do its part. Furthermore, industry is probably in better shape than ever before to help the nation in any crisis that may arise because our total manufacturing capacity is estimated to be approximately 50 per cent greater than it was ten years ago. The General Electric Co., for example, has announced that in case all-out mobilization should become necessary, that company could produce on a basis double its output during the last World War.

One thing is certain—not much time need be lost in the erection of new plants because plant expansion during the last war has provided practically all the facilities that would be necessary for the country to arm itself and our international friends for any contingency. Some industries, like the machine tool industry, have been operating for several years on a reduced basis, and these will experience difficulty in getting back the skilled help which found more lucrative jobs. In order to avoid bottlenecks, government officials should apprise such industries as soon as possible of the output likely to be required of them, so that plant personnel can be built up now to meet likely developments.

Regardless of what lies ahead—peace or war—greater productivity will be the solution of the nation's problems. In the metal-working industries, particularly, obsolete time-consuming manufacturing equipment should be quickly replaced with machines of modern design that can turn out work of better quality at faster rates and at less cost.

Charles O. Herb

EDITOR

Making Lay-Out and Detail Drawings

SECTIONAL dies are made up of accurately ground matching components, so that when all the sections are assembled, they form a specified part outline. Among the advantages of sectional dies are the following:

1. By following clearly dimensioned detail drawings when grinding individual die sections, close control over die size is provided, resulting in accurate die products.

2. Die life is appreciably increased because the shearing surfaces of the ground sections have no taper whatsoever, unlike a hand-stoned die-block. The human element is always present in a hand-stoned die, the result being that shearing surfaces are inevitably tapered.

3. Maintenance costs are much lower, because if one section happens to crack or chip while the die is in use, only that particular section will have to be replaced. If this should occur in a die with a solid block, the entire block would have to be replaced, thereby adding to the tooling costs.

4. Splitting the die-block into sections eliminates heat-treating distortion and cracking, because the pieces handled are more uniform in cross-section, thus being less likely to warp excessively when heated to high temperatures in hardening furnaces. In addition, grinding of the sections is more easily accomplished.

5. Section replacement is simplified, because, if necessary, the detailed drawing of a die section and the proper steel may be sent many miles away to another tool shop, where the die section can be built to tool drawing specifications, inspected, and sent back to the user's shop. Since this section is made to the original specifications, it can be slipped over its aligning dowels, screwed in place, and the die is then ready to use again. Most manufacturing concerns are equipped to do this phase of tooling themselves. However, where the facilities of a shop are taken up to capacity for tool production, the sub-contracting system can be readily and profitably used.

6. By the use of grinding machines, different clearances between punches and dies for various stock thicknesses can be accurately controlled through close adherence to dimensions on detailed drawings. On hand-stoned dies, these clearances vary and are seldom held uniformly around the entire periphery of the die outline.

7. Uniform wear allowances can be established around the entire periphery of the die opening, these allowances being taken into consideration when dimensioning the die sections.

Some of the disadvantages of sectional dies include:

1. Sectional dies must be drawn in detail and dimensions thoroughly and accurately checked prior to making the die. The building phase is also rather expensive. Therefore in order to

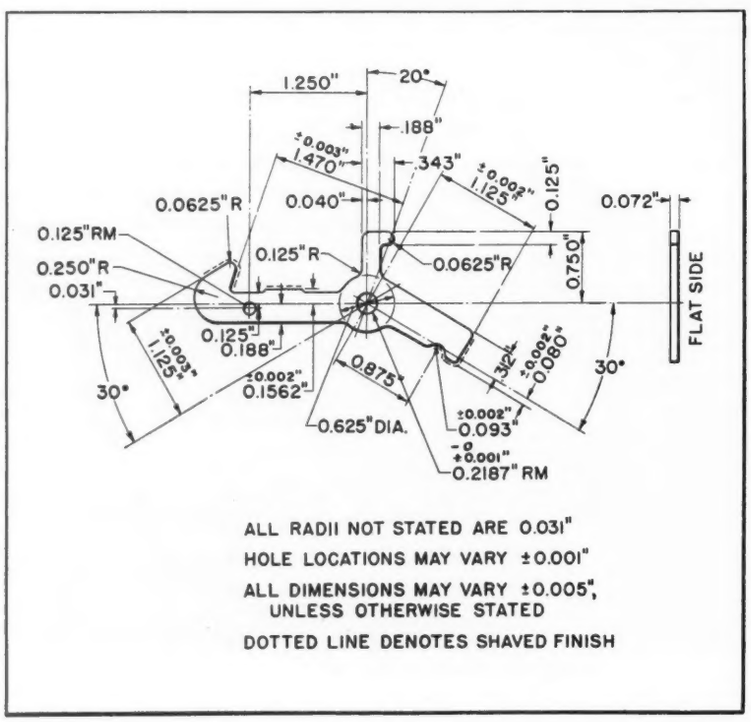


Fig. 1. Sectional type dies are especially advantageous for producing parts of complicated shape, such as the one here shown

for Sectional Ground Dies

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Dayton, Ohio

produce sectional dies, the tooling budget must be greater than that allowed for other dies.

2. Sectional dies cannot be profitably used unless the press, bolster plate, and sub-plate conditions are ideal. If the bed and ram of the punch press are not absolutely parallel, proper alignment between the punch and die will be extremely difficult to maintain. Unusually small clearances make such ideal conditions imperative, and for the best results, precision die sets should be used with sectional dies.

When all the facts are considered, for the high production of accurately shaved die products of complicated shape, the advantages of sectional ground dies definitely outweigh the disadvantages. Generally, high-carbon, high-chromium steels are employed for punches and die sections and both are hardened and ground. Wedge blocks may be made of medium chrome steel, hardened and ground, and sub-plates may be made of soft machine steel.

Fig. 1 is a drawing of a typical part to be produced in a sectional die. The dotted lines designate the surfaces that must be smoothly and accurately shaved to the tolerances shown. Note the center lines about which the part is drawn, because these have a direct bearing upon the location of the work holes, which are used as reference points in the construction of the die sections, as will be explained later. A large-scale lay-out should be made from this drawing on which all dimensions are given in decimals, using mean dimensions only for figuring purposes, and locating all radii centers and surfaces.

The die sections are shown in Fig. 2 as they would be positioned prior to being inserted into the sub-plate or retainer for the sections. It will be noted that at least one of the two work holes *A* in each section is located on a center line of the part. This decreases the time needed to calculate the dimensions for the sections and greatly reduces the possibility of errors in these calculations. Two work holes are used in each section to facilitate setting up the parts for grinding. The grinder operator inserts plugs in both holes *A*, and checks each surface in accordance with the tool drawing dimensions. The work holes are ground to diameters in even decimals of an inch, as, for example, 0.100, 0.200, 0.300 inch, etc., thus enabling the operator to either add or subtract an even figure when checking his work. Holes 0.200 inch in diameter are used, if possible, for easier checking.

The proper way to detail each individual die section is illustrated in Fig. 3. All counterbored, dowel, and work holes are located to decimals of an inch, dowel holes *B* and work holes *A* being accurately ground to the diameters given. All dimensions are given from the work hole that lies on a part center line. If both work holes lie

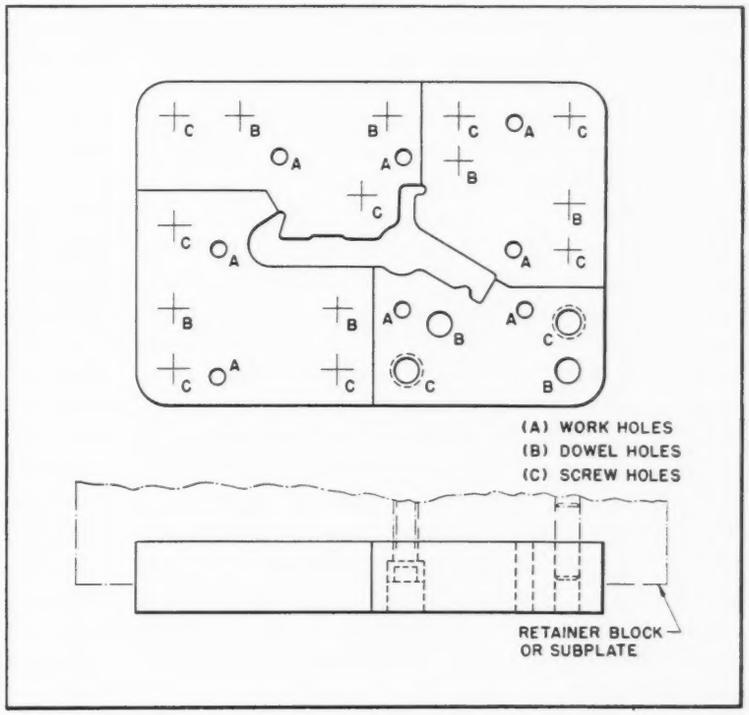


Fig. 2. Assembly of die sections for blanking the part shown in Fig. 1. Note location of work holes (A) on center lines of part

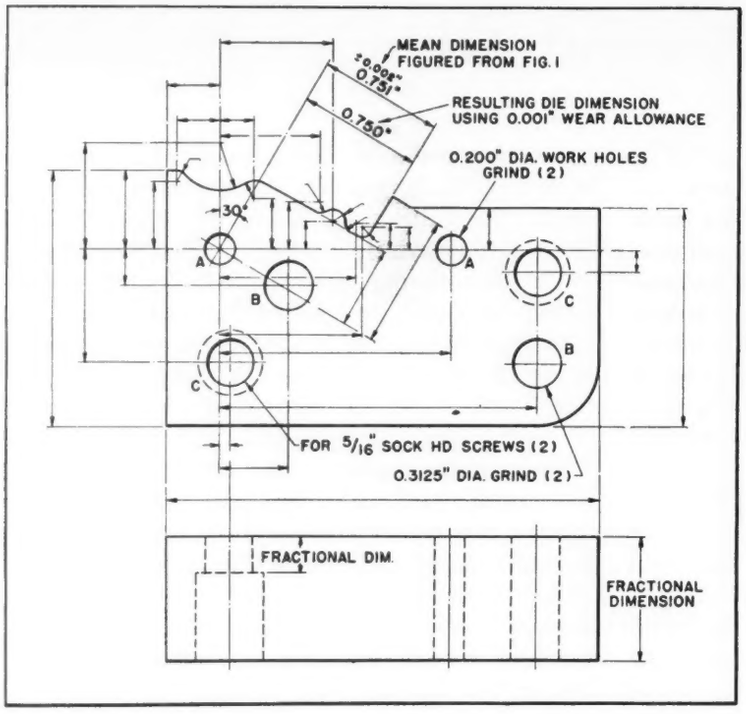


Fig. 3. Detail of die section showing method of dimensioning. All the screw and dowel holes are located from one of two work holes (A)

on a center line, the one nearer the part outline is used as the master hole. The over-all dimensions of the die section are also given. These are included so that when the sections are assembled the outer surfaces will be flush and will fit snugly in a retaining block or sub-plate.

Another method of constructing sectional dies is shown in Fig. 4. This method is utilized when only two die sections are necessary. The hardened and ground wedge holds the sections together when they are being doweled in place and acts as a supporting plate when the die is in use. Work holes *A* and dowel holes *B* are accurately ground to tool drawing specifications, and all hole locations are given in decimals as explained previously. Every surface and radii center is located in decimals from one work hole, and the length and width of each die section are accurately established. The retaining plate is machined all the way through from front to back, as the sections need support on only two sides.

To insure the proper construction of dies, certain notes regarding clearances, wear allowances, and other details should be placed on the drawings. The following are typical of the notes to be given on tool drawings: (1) "Toolmaker to provide slots or 3/16-inch diameter holes wherever necessary for disassembling purposes." (This note should be given on assembly drawings.) (2) "... inch has been allowed for punch clearance." (This note appears on punch drawings.) (3) "... inch has been allowed for wear on die sections." (This note is given on die section drawings.)

How much to allow for wear is a controversial subject. When dimensioning die sections in accordance with part specifications, it is good practice to use a safety factor of at least 0.0005 inch from either the high or low limit and to avoid using dimensions that are more than 0.001 inch from the mean figure. In Fig. 1, for example, one of the 1.125-inch dimensions has a tolerance of ± 0.002 inch. Therefore, the mean dimension of 0.751 inch from the work hole shown in Fig. 3 also has a tolerance of ± 0.002 inch. If we use 0.0005 inch as the safety factor added to the low limit, the die dimension becomes 0.7495 inch. But 0.7495 inch is 0.0015 inch subtracted from 0.751 inch, so it is incorrect. Using 0.750 inch will be correct, because it does not vary more than 0.001 inch from the mean dimension and it is more than 0.0005 inch from the extreme low limit of 0.749 inch. In this case, a dimension smaller than the mean dimension was used so that the die surface will approach the mean dimension of 0.751 inch as it wears.

A die section should never be dimensioned in such a manner that the shearing edges wear away from the mean engineering dimensions. The dimension shown on the tool drawing is based on the wear allowance and is calculated from a mean dimension which carries the smallest tolerance on the engineering print. The smallest tolerance on the part shown in Fig. 1 (except for the holes) is ± 0.002 inch, so the wear allowance for all surfaces is 0.001 inch.

Punches are laid out in a manner similar to that used for the dies in that two work holes are

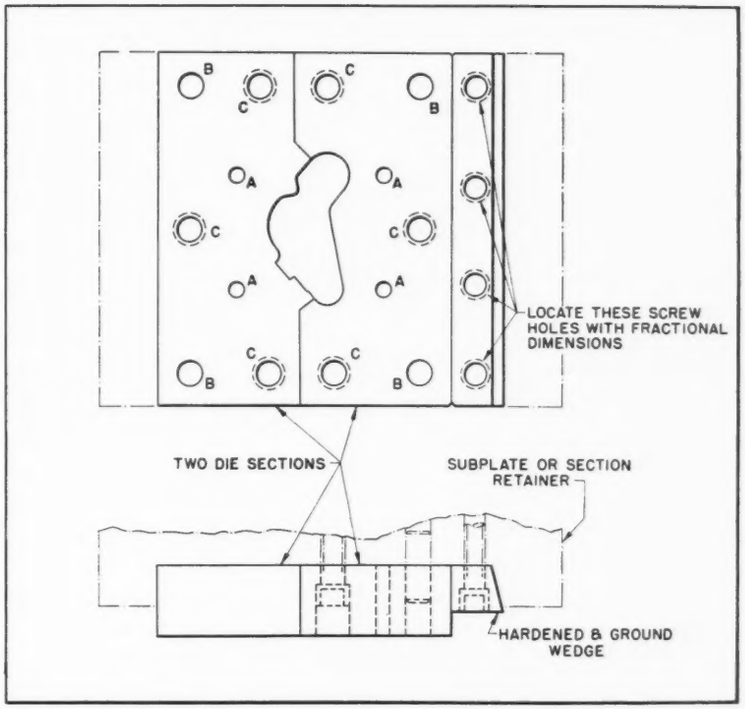

LOCATE THESE SCREW HOLES WITH FRACTIONAL DIMENSIONS
TWO DIE SECTIONS
SUBPLATE OR SECTION RETAINER
HARDENED & GROUND WEDGE

Fig. 4. Hardened and ground wedges are often employed for holding two-piece sectional dies together while doweling them in place

ground in the flange and all punch surfaces and radii centers are located from one hole. As was explained in referring to the die sections, two holes are used to facilitate setting up and grinding. Where studs are used to locate the part on the punch, the stud holes should not be used for set-up purposes because these holes will not remain perfectly round after the studs have been driven out a few times for sharpening the punch face. All holes should be located by decimal dimensions and, with the exception of counterbored holes, should be ground to the dimensions specified.

When figuring the punch dimensions of a shaving die, 0.0003 inch clearance on a side is allowed between the punch and die, this allowance being made on the punch only. In establishing the clearance between the punch and die of a compound blanking and piercing die, the material hardness and different stock thicknesses must be taken into consideration. Shaving allowances for dies depend upon the material, stock thickness, number of shaves to be made, etc.

* * *

The use of tungsten in electric-light bulb filaments is well known. However, the steel industry takes about 90 per cent of the tungsten consumed in this country, while the manufacture of light bulbs requires less than 2 per cent. The remainder is used in tungsten carbides, chemicals, and dyes. The most important use of tungsten is as an alloying element in tool steels.

Special Tool-Head Triples Production in Machining Pumps

By using only one tool-head to hold all the tools required for nine simultaneous roughing operations on cast-aluminum converter pumps for the Packard Ultramatic drive, the production output per machine per hour has been tripled.

The new tooling set-up employs modified standard Carboloy tools in a Gisholt No. 12 high-production lathe, permitting the removal of about one pound of metal in thirty seconds. Cutting speeds on the 13 1/2-inch diameter aluminum casting range as high as 3400 surface feet per minute.

The operation consists of nine cuts—three facing, one boring, three combined boring and facing, and two combination facing and chamfering cuts. The total feed is 0.012 inch per revolution.

Seven of the tools are Carboloy standard styles (Grade 883), slightly modified so as to have a 10-degree front rake and a 12-degree side rake. The use of the seven standard style tools reduces tool cost and also tool inventory requirements. One complete set of sharpened tools is kept in the tool-room, and one sharpened set is in readiness at the machine while a third set is in use.

Three of the tools are changed after machining approximately 200 pieces, the change requiring less than twenty minutes. The other six tools only require sharpening after the machining of 2000 pieces.

"Brain Block" Control of Standard Lathe Increases Output Seven Times

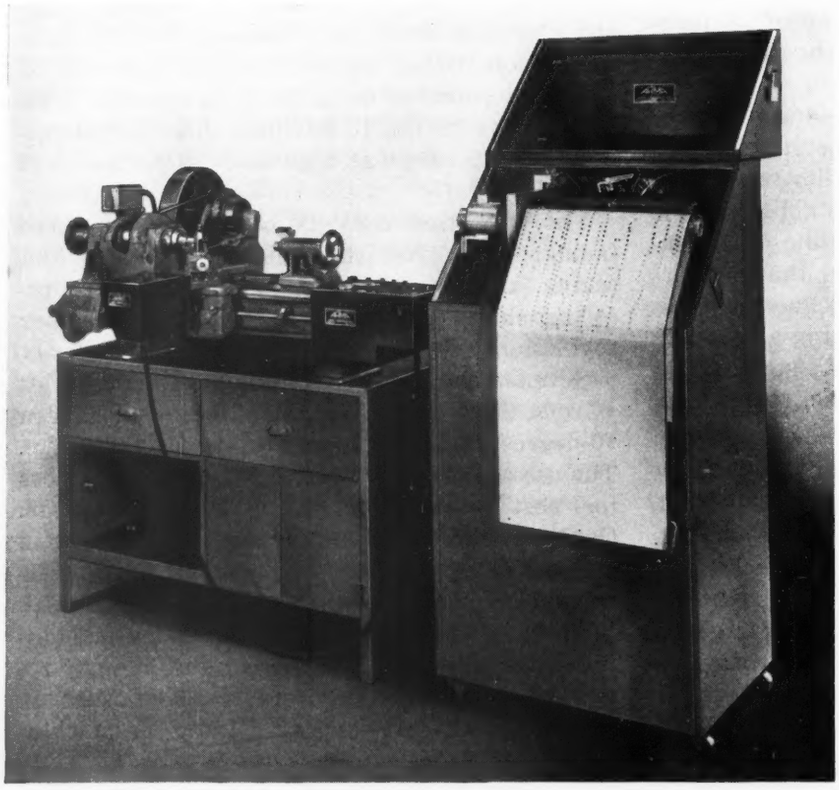
A NEW method of automatic machining involving a "Brain Block" technique for operating standard machine tools with computer-controller devices has been developed by the Arma Corporation, Brooklyn, N. Y. The equipment, which will be known under the trade names of Armamatic precision controls and Armatrol precision transmissions, permits automatic operation of standard machine tools at economies impossible with manual operation. The method is particularly applicable to small-lot, repetitive production, where the use of standard automatic machines would be impractical due to set-up costs. Parts once made in this way can be automatically reproduced after any period of time with minimum modification of the set-up.

The equipment is shown in the illustration applied to a standard South Bend bench lathe. Information from the drawing of the part to be produced is translated into a series of punched holes in a paper roll. This operation, at the present stage of development, requires an experienced person, but if the necessary information were tabulated on the drawing by the designer or engineer, it could be transferred to the paper roll by an inexperienced typist.

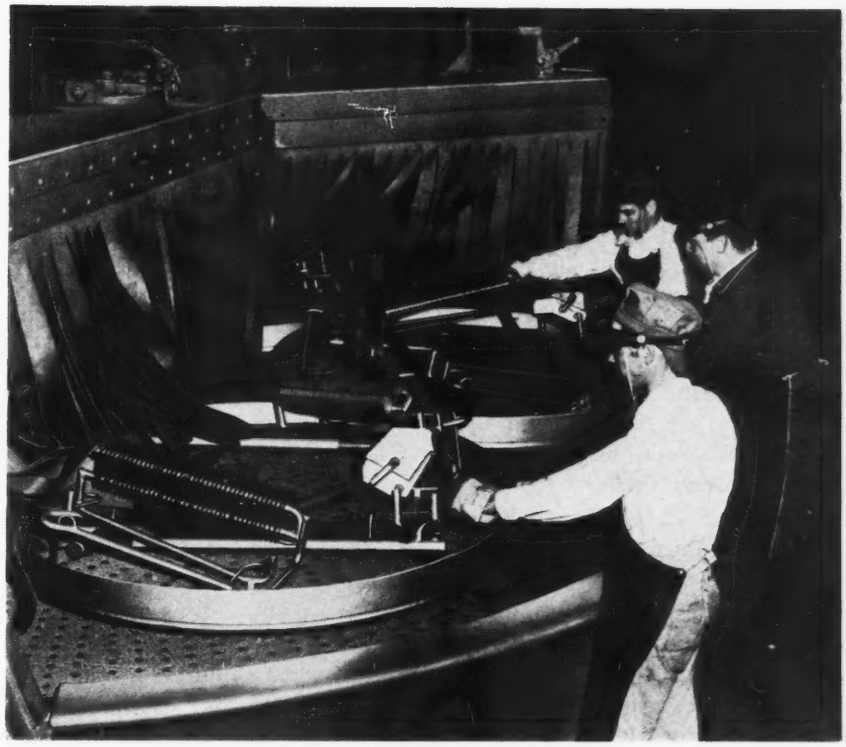
It now requires about fifteen minutes to punch a paper roll for producing a simple shaft having three or four different diameters. Each hole controls either the transverse or the longitudinal movement of the cutting tool for a predetermined length of time (or the distance traveled at a pre-set feed rate) during the cutting cycle. This so-called "piano roll" is only one of several ways of introducing the blueprint into the "brain."

The paper roll is placed in the Armamatic control equipment seen at the right, and a piece of bar stock—precut to the desired length—is gripped in the chuck. When the starting button is pressed, the cutting tools automatically go through the motions necessary to produce the desired part. In the set-up shown, an aluminum shaft having three diameters was turned, faced, and chamfered in about four minutes. It is estimated that it would require a skilled machinist about thirty minutes to produce the same part.

During the machining cycle, the paper roll automatically indexes periodically. When holes in the paper pass beneath the row of contact fingers, the fingers contact the copper drum on which the paper is mounted, thus completing various electrical circuits which actuate the Armatrol precision transmissions and cause the



Standard bench lathe equipped with computer-controller devices for automatically reproducing parts from a perforated paper roll



Coils for freezer shelves and other refrigerator parts are cleaned in two passes on a 14-foot "Rotoblast" unit

tools to feed in the desired direction. A transmission is attached to both the longitudinal leadscrew and the carriage cross-feed.

The precision controls and transmissions employed are assemblies of standard "Brain Block" instrument components made by the Arma Corporation for electrical analogue computers, gun directors, gyro-compasses, and complex remote control systems. Such standard components include electrical resolvers; synchro units; induction motors, generators, and potentiometers; step motors; and mechanical differentials.

Systems for generating master cams and duplicates, and for the precision positioning of the work-piece on jig-borers and grinding machines have also been developed. The controls are also applicable to milling and other machines. A major advantage of this system is that minimum training is required to operate machines so equipped. With about five minutes of instruction, an unskilled operator could run from one to four machines, each producing up to seven times as many parts as a skilled mechanic could on a manually operated machine. The paper rolls employed can, of course, be filed for future production requirements.

No definite plans have been made for marketing this equipment. In fact, initial production of these devices will go on machines in the Arma shops. It is possible, however, that, in the future, Arma will work with various machine tool builders to incorporate the equipment on standard machines or sell or rent equipment to users.

Airless, Centrifugal Blast Cleaning Applied in Refrigerator Production

The airless, centrifugal blast cleaning process known as "Rotoblast," developed by the Pangborn Corporation, Hagerstown, Md., is used in preparing the surfaces of steel refrigerator coils for an aluminum coating. These coils are made of steel tubing and must be joined to the bottom of aluminum freezer shelves used in refrigerators made by Servel, Inc. By coating the coils with aluminum and at the same time metallically bonding them to the shelves, excellent heat transfer is provided.

A 14-foot "Rotoblast" table, shown in the accompanying illustration, is used to prepare these coils for the aluminum coating and for the cleaning and surface preparation of other small parts prior to assembly. These parts are cleaned in two passes on the Pangborn table at a speed sufficient to keep three operators busy loading, unloading, and turning the pieces. The evaporator coils, gas-heat exchanger assemblies, and other parts are brought to the machine and carried away by an automatic conveyor.

* * *

Factual data compiled by the Department of Commerce show that concentration of industry, whether it is measured in terms of sales, assets, or income, has decreased—not increased— over the past decade.

Die Set-Up that Permits One Press to Handle Multiple Operations

HIGHER output, lower cost, better quality, and added safety are unusual advantages when many different short-run operations on a wide variety of parts are involved. The Federal Auto Products Co., Chicago, Ill., has tooled an 8-ton hydraulic press with a versatile die set-up and is getting such results under these conditions. The press employed is an oil-hydraulic Multipress made by the Denison Engineering Co., Columbus, Ohio.

Engineers at the Federal plant have designed a die nest adaptable to dozens of different dies. The nest is mounted on the bed of the press. Any of the dies can be changed within five minutes, thus enabling rapid switchover from one operation to another. New operations are constantly being adapted to this set-up, and over 100 interchangeable dies are planned for use in this single die nest.

In one operation on this press, metal tubes having a wall 0.035 inch thick are flared. A two-piece flaring die is used as shown diagrammatically in Fig. 1, and the flaring punch is mounted on the press ram. The operator places the tube in the die and then presses dual control levers. Pressure is first directed to a sequence valve on top of the machine, which controls the closing of the die.

Upon reaching the sequence valve setting, the pressure is then directed to the press ram, causing it to descend and flare the tube, after which it returns to its upward position. To remove the flared tube from the die, the operator simply steps on a foot-pedal that operates the hydraulic clamping cylinder. The use of a secondary circuit for clamping insures that the flaring tool is stripped easily from the tube before the clamping action is released.

Another unique set of dies employed on the same press permits the bulging and flanging of

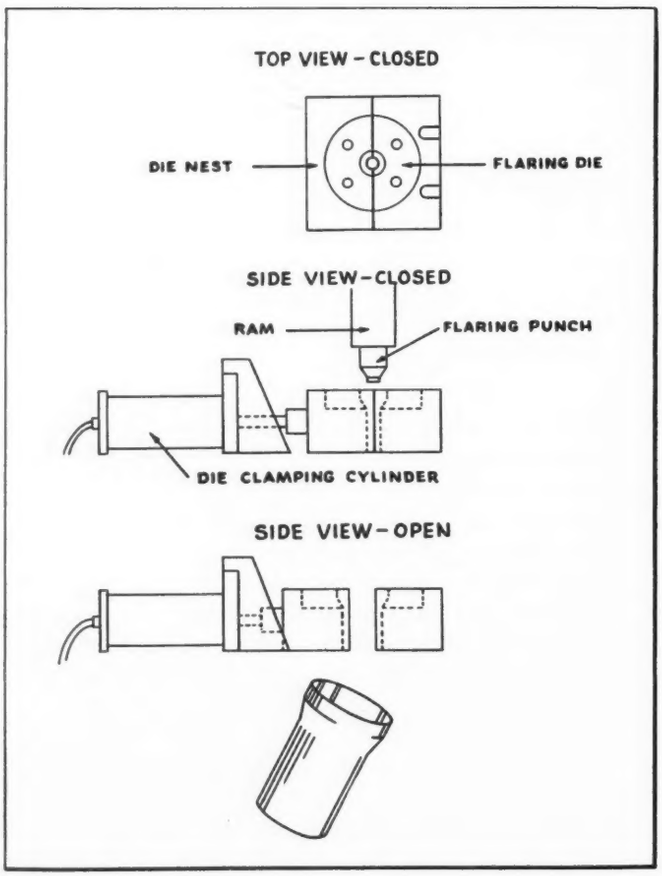


Fig. 1. Short tubes such as the one shown at the bottom are flared by means of this tooling set-up. Wall thickness of the tube is 0.035 inch

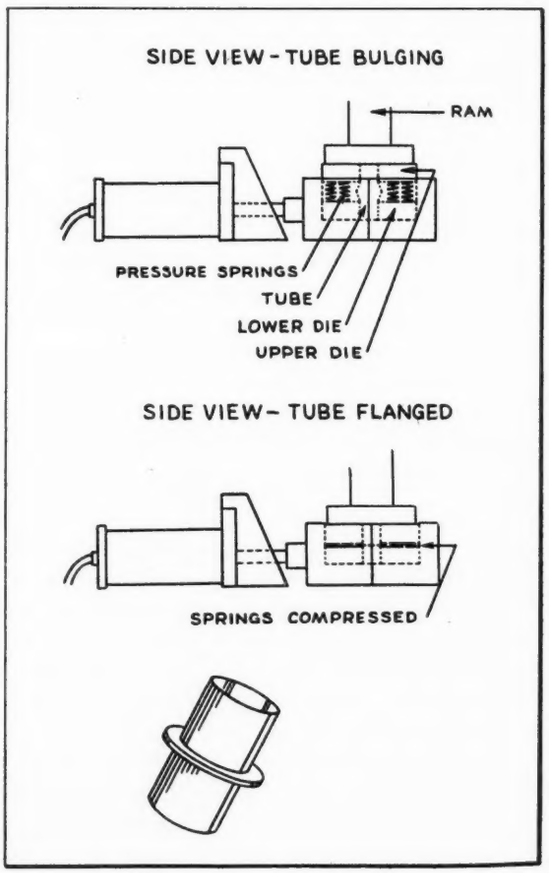


Fig. 2. Metal tubes are bulged and flanged in a single down stroke of the hydraulic press ram by means of this special die

Fig. 3. An 8-ton hydraulic press equipped with a special die nest which accommodates many different dies. Dies can be changed within five minutes

short metal tube sections at a single down stroke of the ram. With the former method, this operation required two separate production steps. The parts produced are end pieces for automobile exhaust pipes.

This set of dies consists of upper and lower halves, held apart by springs as seen in Fig. 2. The tube is placed in the die, and as the ram exerts accurately controlled, preset pressure against the end of the tube, the sides of the tube start to bulge into the die openings. Upon the continued downward movement of the ram, the springs are compressed and the tooling flattens this bulge into a flange.

The former method used on this job required first that the tube be placed on a V-type roller to form the bulge. Then the part was put in a press that compressed the bulge into a flange. In addition to eliminating a production step, the present set-up provides an extra safety factor. The operator's hands must be held on the dual control lever while the press ram is in action, as shown in Fig. 3. If either hand is removed, the ram stops, and if both are lifted from the levers, the ram rises to the "up" position. The die is opened and the part removed as in the tube-flanging operation previously described. The clamping cylinder and press ram are operated through a sequence circuit that insures proper clamping of the part before the work cycle starts.

In these typical Multipress applications at the Federal Auto Products Co.'s plant, fast, easy die interchange and accurate pressure control are shown to be an effective combination adaptable to a wide range of production needs.

International Standardization Organization to Meet in the United States

THE International Organization for Standardization has accepted an invitation to hold its 1952 General Assembly in the United States. Delegates of the twenty-nine countries that are members of the organization will be guests of the American Standards Association. As United States member, the ASA presents the viewpoint of United States groups on standards that come before the International Standardization Organization. More than 100 national technical societies and associations and some 1700 leading industrial firms are ASA members.

Seventy-one international technical committees are working to bring about agreement on definitions, terminology, specifications, dimensions, and test methods in the national standards of the member countries to increase understanding and easier interchange of products. Among the items in which the United States is taking an active interest are screw threads; ball and roller bearings; iron and steel; aircraft and automobiles; copper and copper alloys; small tools; rubber; and plastics.

* * *

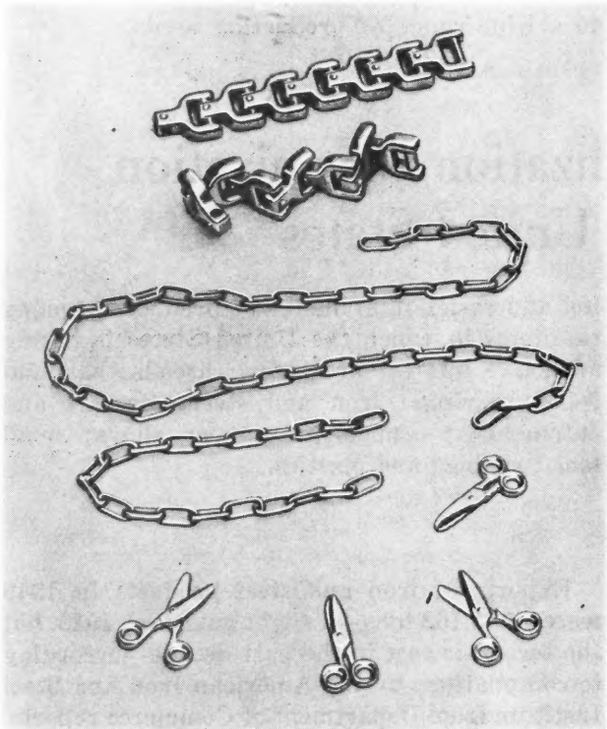
Exports of iron and steel products in 1949 were 4,685,462 tons—a slight gain over 1948, but the second lowest in the past decade—according to compilations by the American Iron and Steel Institute from Department of Commerce reports. The tonnage of exports in 1949, however, was slightly more than 8 per cent of the total shipments, compared with 6.6 per cent in 1948.

Engineering News

Parts with Movable Elements Cast in One Automatic Operation

An "Intercast" method of die-casting has been announced, by means of which two or more movable complementary elements can be cast simultaneously in one completely automatic operation. The cast parts are assembled and trimmed, ready to be plated or used immediately. This new process, which was developed by the Gries Reproducer Corporation, of New York City, substantially reduces costs and opens up new design possibilities for multiple-element products.

Three types of "Intercast" products are shown in the accompanying illustration. The miniature scissors are made up of two elements, which were cast in one primary operation, with the freely movable blades in proper relation to each other and hinged together by a pivotal, rivet-like member which is an integral part of the casting. In the continuous-link chain illustrated, the loose links are solid elements without joints of any kind. Chains of this type can be cast in continuous lengths of thousands of feet or in predetermined lengths containing any desired number of links. The pintle chain, with V-shaped parts, shown at the top of the illustration, has precise-fitting hinge elements that are freely movable.



Pintle and continuous-link chains and miniature scissors having movable elements that are cast simultaneously in one automatic operation

Flame Temperature Measured by Infra-Red Techniques

Temperatures of flames 5 feet in diameter and reaching 5000 degrees F. can now be measured with an accuracy approaching $\pm$ 1 per cent, according to a statement by Dr. W. S. Tandler, executive director of Industrial Scientific Co. of New York City, whose staff has pioneered in applying the new science of flame pyrometry. The need for such flame measurements has arisen with the development of ram jets, turbo jets, and rockets.

Infra-red radiation from a source of known emission is passed through the high-speed, hot gas stream, and focussed on the entrance slit of a Perkin-Elmer infra-red monochromator. The radiant energy at a certain wave length is measured and recorded. By standardizing the energy and simple electronic computing, the instrument can be made to record a single value on a scale marked in any temperature units desired.

New Atom Smasher to be Used for Fundamental Nuclear Research

One of the most powerful atom smashers of its type in the world—a 100,000,000-volt betatron, built by the General Electric Co.—is now installed and undergoing tests at the University of Chicago. The 160-ton giant is to be used for atomic research and X-ray studies by the experimental staff of the University's Institute for Nuclear Studies.

The atom smasher requires a thick-walled housing to prevent escape of radiation. This "shield" was designed by the scientists who developed the shields for wartime atomic bomb piles. The operating end of the betatron is a huge electromagnet, made of laminated silicon steel weighing 160 tons. This magnet is 10 1/2 feet high, 6 feet wide, and 17 feet long. The electromagnet accelerates and maintains electrons in a circular path around a doughnut-shaped acceleration chamber. At a predetermined time, the path of the electrons is changed

slightly, so they strike a small piece of metal inside the doughnut-shaped chamber, producing an X-ray beam. These X-rays are many times more penetrating than those produced by conventional X-ray machines and by radioactive substances such as radium.

Occupying the entire area of another room is one of the largest banks of capacitors ever built. They are connected to the electromagnet, which is excited at 24,000 volts. Control equipment for the huge new machine, involving an elaborate series of switches, dials, and measuring instruments, is located in a third room.

Westinghouse Reveals New Induction Heating Technique

A new technique for the induction heat-treating of non-ferrous metal strip, such as aluminum, brass, copper, magnesium, and stainless steel—known as "transverse flux induction heating"—was recently revealed by the Westinghouse Electric Corporation. Conventional radio-frequency induction heating is not suitable for heating non-magnetic strip because of low power factor and inefficiency, and because the small cross-section of the non-magnetic strip intercepts only a very small percentage of the flux through the inducing coil. The transverse flux method, however, overcomes this difficulty, since magnetic flux is directed perpendicular to the surface and through the strip, instead of along its length as in conventional practice.

Transverse flux induction heating is accomplished by passing the strip between two opposing laminated pole structures. The field coils, supplied with alternating current, are oppositely polarized, so that the flux is forced through the strip. Frequencies of from 60 to 10,000 cycles per second are used with this system, depending on the thickness of the strip and its resistivity.

Behavior of Liquid Helium Studied at M.I.T.

The doors to the frigid world of absolute zero (459 degrees below zero on the Fahrenheit scale) have been opened to undergraduate students at the Massachusetts Institute of Technology. Twelve senior students have completed their required undergraduate research projects by making studies of the behavior of liquid helium—helium gas so cold (452 degrees below zero) that it turns into a colorless liquid, just as steam turns into water at 212 degrees above zero.

At about 2 degrees below its boiling point, liquid helium begins to act in a manner unlike any other material known and enters what seems to be a "fourth state of matter." It climbs up the sides of its containers and no dish can float in it. It conducts a pulse of heat in much the same way that ordinary liquids conduct a wave of sound.

Exhibiting these peculiarities, liquid helium is called—for want of a better term—helium II. The heat waves flowing through it are called "second sound." Physicists think that an explanation of these phenomena, when achieved, may lead them to general information about the structure and behavior of all materials.

World's Largest Injection Molder Produces 200-Ounce Parts

The world's largest injection molding machine, manufactured by the Watson-Stillman Co., Roselle, N. J., was recently installed in the A. L. Hyde plant at Grenlock, N. J. The huge machine is capable of pressing out, at one time, thermoplastic products weighing approximately 200 ounces. Examples of work produced with this equipment include television, radio, and air-conditioning unit cabinets; refrigerator door linings; kitchen cabinet doors; and washing machine agitators and tubs.

This molding machine has a nozzle pressure of 21,000 pounds per square inch and a clamping capacity of 1000 tons. It measures 24 feet 8 inches long, by 5 feet wide by 12 feet 11 inches high, and weighs 115,000 pounds. The platen is 60 by 40 inches, and the daylight opening of the machine is 54 inches. The hopper holds 300 pounds of plastic raw materials.

Metallic-Coated Glass Mirrors Reflect Only One Color

Mirrors that reflect only one color of light—red, blue, or green—are being used by Westinghouse Research scientists to explore new methods of transmitting and receiving color television pictures. By depositing ultra-thin layers of metallic compounds on clear glass, mirrors that "see" and reflect only one color are produced.

The clear sheets of glass are placed in a glass-jar "oven" from which most of the air has been evacuated. A special metal compound is then electrically heated until it melts and the vapors are directed through the glass jar. As the vapors strike the glass sheet, they form the desired film. The thickness of the film determines the color reflected. To reflect blue, for example, the thickness may be one-fourth the wave length of blue light, or about sixteen millionths of an inch.

Adjustable Set-Up for Broaching Different Sized Hand Stamps

BOTH sides of vanadium tool steel blanks for hand stamps are accurately tapered by surface broaching at the plant of New Method Steel Stamps, Inc., Detroit, Mich. From six to fifteen of the hand-stamp blanks are broached with each stroke of the machine, the quantity varying with the size of the blanks. A feature of particular interest in the set-up for this operation is the provision for handling different sized work by means of simple adjustments. Blanks from 1/4 to 5/8 inch square and of various lengths can be broached with the same set-up.

The operation is performed on a Colonial 10-ton, 36-inch stroke broaching machine equipped with a manually operated fixture, as seen in the accompanying illustration. The blanks, which are pre-cut to the proper length, are stacked vertically in a U-shaped magazine. A jack-screw is rotated to clamp the stack of blanks rigidly, and the trunnion type fixture is swung vertically into the broaching position by using the jack-screw as a handle. A wedge type locking bar is then swung into place behind the fixture to hold it at the proper distance from the broach for the particular size of blank being machined. When the ram has completed its downward stroke, thus broaching two sides of the stack of blanks to a 15-degree taper, the fixture is unlocked, swung back, and unloaded while the ram returns.

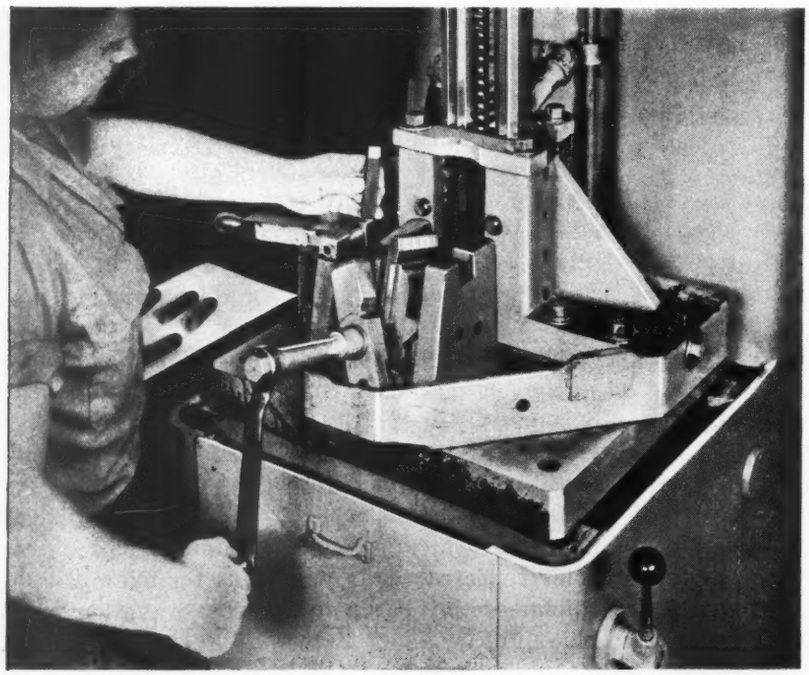
The two separate broaches employed for this operation are attached to the ram by means of a cross-head and T-slot arrangement. This permits lateral adjustment, so that the two opposing sets of cutting teeth can be moved apart or together for broaching different sizes and quantities of blanks. The broach guides are also adjustable, being of split construction and mounted on ways so that the two halves can be adjusted laterally by means of screw-operated wedges. The magazine, which is normally locked in the fixture, is readily interchanged when shifting from one size blank to another.

To produce bevels on all four sides, the blanks are reinserted in the magazine in a position which is 90 degrees to the first cutting position, and given a second pass. After the required characters have been engraved on the face of the blanks, the small amount of surplus bevel is removed in a wet grinding operation.

The set-up described combines the advantages of high output characteristic of broaching with adaptability to short-run production.

* * *

The effect of intense vibration on complex electrical equipment for airplanes is determined rapidly by the use of a vibration generator at the Aircraft Department of the Westinghouse Small Motor Division at Lima, Ohio. With this equipment, a small circuit-breaker can be subjected to from 20 to 1600 impulses a second, and a few hours on the test rack is equal to 1000 hours in a plane. High-speed pictures of the apparatus under vibration test are taken, and these are studied to determine the detailed effect of the vibration and thus obtain information of value in designing more rugged equipment.



Means for quick adjustment are provided in this broaching set-up to permit forming a clearance taper on the sides of various sized hand stamps. From six to fifteen blanks are broached on two sides simultaneously

Design of Involute Gear Hobbing Cutters

By F. G. WATTS
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IN the first article on this subject, published in August MACHINERY, page 152, the theoretically correct hob thread form was discussed and an approximate hob thread form for design purposes was developed. Basic factors and formulas relating to the design of gear-hobbing cutters were also presented.

In this article, examples will be worked out to show the methods of designing hobs having approximate and correct thread forms. In each case, the hob has a pitch diameter of 4.500 inches, a diametral pitch of 5, and a pressure angle of 20 degrees.

The first two examples are for hobs of the approximate form, one with axial flutes, and the other with helical flutes. It will be noted that Case 1 deals with hobs for cutting straight-toothed gears, while Case 2 deals with hobs for cutting helical gears. It should not be assumed, however, that a hob for helical gears must have helical flutes or that a hob for straight gears must have axial flutes.

Design Schedules for Hobs of Approximate Thread Form

1. Diametral pitch of gear to be cut $= P = 5$
   Circular pitch of gear to be cut $= P_c = \frac{\pi}{P} = 0.6283$ inch

	Case 1	*Case 2*
2. Helical angle of gear to be cut $= \lambda_g$	$= 0$ deg.	30 deg.
3. Normal diametral pitch of gear $= \frac{P}{\cos \lambda_g} = P_n = 5$		5.7735
Normal circular pitch of gear $= \frac{\pi}{P_n} = P_{cn} =$	0.6283 in.	0.5441 in.
4. Normal pressure angle of gear $= a_n =$	20 deg.	20 deg.
5. Type of flutes (These may be axial or helical, irrespective of the type of gear to be cut.)		
	Axial	*Helical*
6. Number of threads in hob $= n =$	1	3

(Generally, hobs for cutting straight-toothed gears are single-start, while those for helical gears are multi-start, but this is not an invariable rule.)

	Axial	*Helical*
7. Mean pitch diameter of hob $= R_{ph} =$	4.500 in.	4.500 in.

(It is assumed that the hob axis is free to swivel. If it is not free to swivel, then the pitch diameter and number of threads must be adjusted to bring the lead angle to the required value. Apart from this, the pitch diameter depends mainly on the spindle diameter.)

8. Mean lead angle of hob thread $= \theta = \sin^{-1}\left(\frac{nP_{cn}}{2\pi R_{ph}}\right) =$	2° 33′	6° 38′
9. Hand of hob	Right or Left	
10. Addendum of hob teeth = Dedendum of hob teeth = Dedendum of gear teeth $= D = \frac{1.250}{P_n} =$	0.250 in.	0.2165 in.
11. Axial pitch of hob $= P_{cn} \sec \theta =$	0.6289 in.	0.5478 in.
12. Lead of hob $= L = nP_{cn} \sec \theta =$	0.6289 in.	1.6433 in.
13. Lift of relieving cam $= r =$	say, 0.200 in.	0.200 in.

(The lift of the relieving cam will depend on the pitch of the hob, the designer's own ideas and the cams available. The value generally lies between 0.500 and 0.100 in.)

14. Pitch circle diameter of hob, when new $= 2R_{phn} = 2R_{ph} + \frac{r}{2} =$	4.600 in.	4.600 in.

(If it is assumed that the flute width is approximately equal to one third of a hob tooth length, then from strength considerations only the front two-thirds of the tooth are usable. The mean diameter will therefore be reached when

one-third of the tooth has been ground away. The allowance on radius will therefore be $r/4$.)

	Case 1	Case 2
15. Mean lead angle of hob, when new $= \theta_n = \cot^{-1}\left\{\frac{2\pi R_{phn}}{L}\right\}$	$=$	2° 30′	6° 29′
16. Normal pitch of hob, when new $=$ (Axial pitch) $\cos \theta_n =$		0.6284 in.	0.5443 in.
17. Axial thickness of hob teeth, when new, for axially fluted hob, at pitch radius $= \frac{\text{Axial pitch}}{2}$	$=$	0.3144 in.	—
Normal thickness of hob teeth, when new, for helically fluted hob, at pitch radius $= \frac{\text{Normal pitch}}{2}$	$=$	—	0.2722 in.
18. Number of flutes on hob	$=$	say, 14	say, 14

(The number of flutes should not be a simple multiple of the number of threads. The number should be such as to give reasonable tooth proportions.)

19. Lead angle of flutes	90 deg.	(90 deg.—θ)
20. Lead of axial flutes $= L_f = \infty$	—	
Lead of helical flutes $= L_f = 2\pi R_{ph} \cot \theta =$	—	121.56 in.
21. Axial pressure angle of hob thread, as given by Equation (6), for axially fluted hob $= \alpha_r =$	20 deg. 1 min.	
Distortion angle of top land, in an axial plane, as given by Equation (19) $= \beta_t =$	1 deg. 19 min.	
Axial pressure angle of thread, as given by Equations (20), (21), for helical flute hob, on side having increased lead $= \beta_g =$	—	20° 16′
on side having reduced lead $= \beta_l =$	—	19° 58′
Axial pressure angle of thread, for helically fluted hob, ignoring distortion effects by Equation (6) $= \alpha_r =$	—	20° 7′

	Case 1	Case 2
22. Outside diameter of hob, when new $= 2R_{phn} + 2D =$	5.100 in.	5.033 in.
23. Root diameter of hob, when new $= 2R_{phn} - 2D =$	4.100 in.	4.167 in.
24. Length of threaded portion of hob	7 in.	7 in.

(This length should be fairly great to increase hob life, but is controlled by the length available on the tool spindle. It must not be so long as to cause undue cutting away of metal at the centers of double helical gear faces.)

25. Tool setting	Radial	Radial
26. Thread form at tip and root: tip radius	0.078 in.	0.068 in.
root radius	0.050 in.	0.043 in.

Since a hob of the approximate form has a thread that is slightly thick at crest and root, some tip relief and root relief will be automatically provided. In general, the amount of tip relief given will be within the limits allowed by the British Standard Specification for Machine-Cut Gears No. 436:1932, even if the root relief is regarded as a supplementary tip relief. In cases where the total relief given would be excessive, a small degree of tip rise and root rise may be imparted to the forming tool and grinding wheel, the amount necessary being determined by use of Equations (7) and (8).

The thread profile is usually rounded at tips and roots. The fillet radius allowed may cover the whole of the non-effective part of the tooth; that is, a depth at the bottom of the thread equal to $\frac{0.25}{P_n}$.

The tip radius on the hob controls the fillet radius on the gear cut by the hob. It is sometimes said that the tip radius on the hob and the fillet radius on the gear are equal. This is not the case, as has been shown by Buckingham, but the variation is generally so small that it may be ignored. The tip radius of the thread may be calculated on the assumption that the approximate hob thread is conjugate with the basic rack.

Design Schedules for Hobs of Correct Form

1. Diametral pitch of gear to be cut $= P = 5$
   Circular pitch of gear to be cut $= P_c = \frac{\pi}{P} = 0.6283$ in.
2. Helical angle of gear to be cut $= \lambda_g = 30$ deg.

3. Normal diametral pitch of gear $= P_n$

$$= \frac{P}{\cos \lambda_g} = 5.7735$$

Normal circular pitch of gear $= P_{cn}$

$$= \frac{\pi}{P_n} = 0.5441 \text{ in.}$$

4. Normal pressure angle of gear $= a_n = 20$ deg.

5. Number of threads in hob $= n = 3$

6. Mean pitch diameter of hob $= 2R_{ph} = 4.500$ in.

7. Mean lead angle of hob thread $= \theta$

$$= \sin^{-1} \left\{ \frac{nP_{cn}}{2\pi R_{ph}} \right\} = 6 \text{ deg. } 38 \text{ min.}$$

8. Hand of hob — Right or left

9. Addendum of hob teeth
= Dedendum of hob teeth
= Dedendum of gear teeth $= D$

$$= \frac{1.250}{P_n} = 0.2165 \text{ in.}$$

10. Axial pitch of hob $= P_{cn} \sec \theta = 0.5478$ in.

11. Lead of hob $= L$
$= n P_{cn} \sec \theta = 1.6433$ in.

12. Amount of radial relief $= r =$ say, 0.200 in.

13. Pitch circle diameter of hob, when new
$= 2R_{phn}$
$= 2R_{ph} + \frac{r}{2} = 4.600$ in.

14. Lead angle of thread, when new $= \theta_n$

$$= \cot^{-1} \left\{ \frac{2\pi R_{phn}}{L} \right\} = 6 \text{ deg. } 29 \text{ min.}$$

15. Normal pitch of hob, when new
$=$ (Axial pitch) $\cos \theta_n = 0.5443$ in.

16. Number of flutes in hob $= N =$ say, 14
(Determined as for approximate form hobs)

17. Thread profile angle, at mean pitch radius, of an unrelieved, ungashed thread, as given by Equation (6) $= a_r = 20$ deg. 7 min.
Then, if the hob has axial flutes the design may be carried out on the following lines.

18. Type of flutes, axial

19. Lead angle of flutes $= 90$ deg.

20. Axial thickness of hob teeth, at pitch radius, when new $= \frac{\text{Axial pitch}}{2} = 0.2739$ in.

21. Lead modification, due to relief, as given by Equation (9) $= L_m = 1.0260$ in.

22. Lead angle of thread, on side having increased lead, as given by Equation (10)
$= \theta_g = 10$ deg. 28 min.

Lead angle of thread, on side having reduced lead, as given by Equation (11)
$= \theta_l = 2$ deg. 27 min.

23. Basic-rack pressure angle for hob thread side having increased lead, as given by Equation (12) $= a_{ng} = 19$ deg. 49 min.

Basic-rack pressure angle for hob thread side having reduced lead, as given by Equation (13) $= a_{nl} = 20$ deg. 6 min.

24. Base-circle radius, for thread side having increased lead, as given by Equation (14)
$= R_{bhg} = 1.0127$ in.

Base-circle radius, for thread side having reduced lead, as given by Equation (15)
$= R_{bhl} = 0.2612$ in.

25. Tool angle for thread side having increased lead, as given by Equation (16)
$= \sigma_g = 22$ deg. 45 min.

Tool angle for thread side having reduced lead, as given by Equation (17)
$= \sigma_l = 20$ deg. 37 min.

26. Actual tool relief movement, on thread side having increased lead. (See Fig. 6 on page 157 of August MACHINERY.) $= 0.2260$ in.

Actual tool relief movement, on thread side having reduced lead $= 0.2026$ in.

27. Outside diameter of hob, when new
$= 2R_{phn} + 2D = 5.033$ in.

28. Root diameter of hob, when new
$= 2R_{phn} - 2D = 4.167$ in.

29. Length of threaded portion of hob
$=$ say, 7 in.

30. Thread form at tip and root
(See note for hob of approximate form)

If, however, the hob has helical flutes, the design schedule may be arranged on the following lines:

18. Type of flutes — Helical

19. Lead angle of flutes
$= 90 - \theta = 83$ deg. 22 min.

20. Lead of flutes $= L_f$
$= 2\pi R_{ph} \cot \theta = 121.564$ in.

21. Normal thickness of hob teeth, at pitch radius, when new

$$= \frac{\text{Normal pitch, new}}{2} = 0.2721 \text{ in.}$$

22. Distortion angle of top land, in axial plane, as given by Equation (19)

$= \beta_t$ = 1 deg. 19 min.

23. Flank angle of thread, in axial section, on side having increased lead, as given by Equation (20) $= \beta_g$ = 20 deg. 16 min.
on side having reduced lead, as given by Equation (11) $= \beta_l$ = 19 deg. 58 min.

24. Lead modification, due to relief, on side having increased lead, as given by Equation (22)

$= L_{mg}$ = 1.0339 in.

Lead modification, due to relief, on side having reduced lead, as given by Equation (23)

$= L_{ml}$ = 1.0173 in.

25. Lead angle of thread, on side having increased lead, as given by Equation (24)

$= \theta_g'$ = 10 deg. 43 min.

Lead angle of thread, on side having reduced lead, as given by Equation (25)

$= \theta_l'$ = 2 deg. 32 min.

26. Basic-rack pressure angle for hob thread, on side having increased lead, as given by Equation (26) $= \alpha'_{ng}$ = 19 deg. 56 min.
Basic-rack pressure angle for hob thread, on side having reduced lead, as given by Equation (27) $= \alpha'_{nl}$ = 19 deg. 57 min.

27. Base-circle radius, for thread side having increased lead, as given by Equation (28)

$= R'_{bhg}$ = 1.0261 in.

Base-circle radius, for thread side having reduced lead, as given by Equation (29)

$= R'_{bhl}$ = 0.2723 in.

28. Tool angle for thread side having increased lead, as given by Equation (30)

$= \sigma_g'$ = 22 deg. 33 min.

Tool angle for thread side having reduced lead, as given by Equation (31)

$= \sigma_l'$ = 20 deg. 6 min.

29. Actual tool relief movement, on thread side having increased lead = 0.2314 in.
Actual tool relief movement, on thread side having reduced lead = 0.2020 in.

30. Outside diameter of hob, when new

$= 2R_{phn} + 2D = 5.033$ in.

31. Root diameter of hob, when new

$= 2R_{phn} - 2D = 4.167$ in.

32. Length of threaded portion of hob

= say, 7 in.

33. Thread form at tip and root
(See notes for hobs of approximate form.)

* * *

American Society of Mechanical Engineers to Meet in Worcester

The fall meeting of the American Society of Mechanical Engineers will be held at the Sheraton Hotel, Worcester, Mass., Tuesday, Wednesday, and Thursday, September 19, 20, and 21. More than twenty-five sessions covering many phases of mechanical engineering are scheduled.

The Production Engineering Division will hold three sessions at which five papers will be read. One of these will discuss "Method of Measuring the Metallic Wheel-Loading Characteristics of Grinding Fluids." This paper is prepared by Samuel Manilych, of the Brooklyn Naval Shipyard, and L. H. Sudholz and G. S. Mapes, of the Socony-Vacuum Laboratories. Another paper, by J. Frisch and E. G. Thomsen of the University of California, to be read at the same session, will deal with the "Residual Grinding Stresses in Mild Steel."

At another session, a paper will be presented by Robert S. Hahn, of the Heald Machine Co., on the "Design of Lanchester Damper for Elimination of Metal Cutting Chatter." Also, at this session, A. Bradford Reed, of the Reed Rolled Thread Die Co., will present a paper entitled "A Report on the Development and Status of Thread Rolling."

The third session held under the auspices of the Production Engineering Division will deal with powder metallurgy. Irving J. Donahue, of Shrewsbury, Mass., will read a paper entitled "Considerations in Designing Tools for Powder Metallurgy."

Other sessions at the meeting will deal with management, power, fuels, engineering education and training, machine design, textiles, rubber and plastics, gas-turbine power, properties of gases, hydraulics, materials-handling, metal-cutting data and bibliography and cutting fluids, metals engineering, and wood industries.

During the meeting, inspection trips will be arranged to the plants of the Worcester Pressed Steel Co., Norton Co., Heald Machine Co., General Electric Co., Crompton & Knowles Loom Works, Bay State Abrasive Products Co., Telechron, Inc., Wyman-Gordon Co., Reed-Prentice Corporation, General Motors Corporation, and Heywood Wakefield Co. The banquet will be held Wednesday evening, September 20.

Steel One-Tenth the Thickness of a Human Hair

Steel so thin that it takes ten layers to equal the thickness of a human hair has been produced at the Research Laboratory of the Armco Steel Corporation, Middletown, Ohio. The need for a super-thin alloy steel with special magnetic properties came with the development of high-frequency electronic equipment. Five weeks after being requested to produce this material, Armco technicians were rolling the alloy on a tiny mill especially built for the job. The work-rolls on this mill, though only 5/16 inch in diameter, support pressures measured in tens of thousands of pounds.

A typical production run starts by cold-reducing the steel on a larger mill to a thickness of 0.002 to 0.006 inch. The material is then prepared for the final reduction by cutting the 12-inch wide metal into 2-inch strips. After successive passes through the special mill, the steel has been elongated approximately 400 times and reduced in thickness to 0.00025 inch.

In order to test the performance of these magnetic alloys, the strip is slit into ribbons 1/10 inch wide on a fixture that uses razor blades as cutters. The ribbons are then coated, wound into tiny coils, and annealed.

* * *

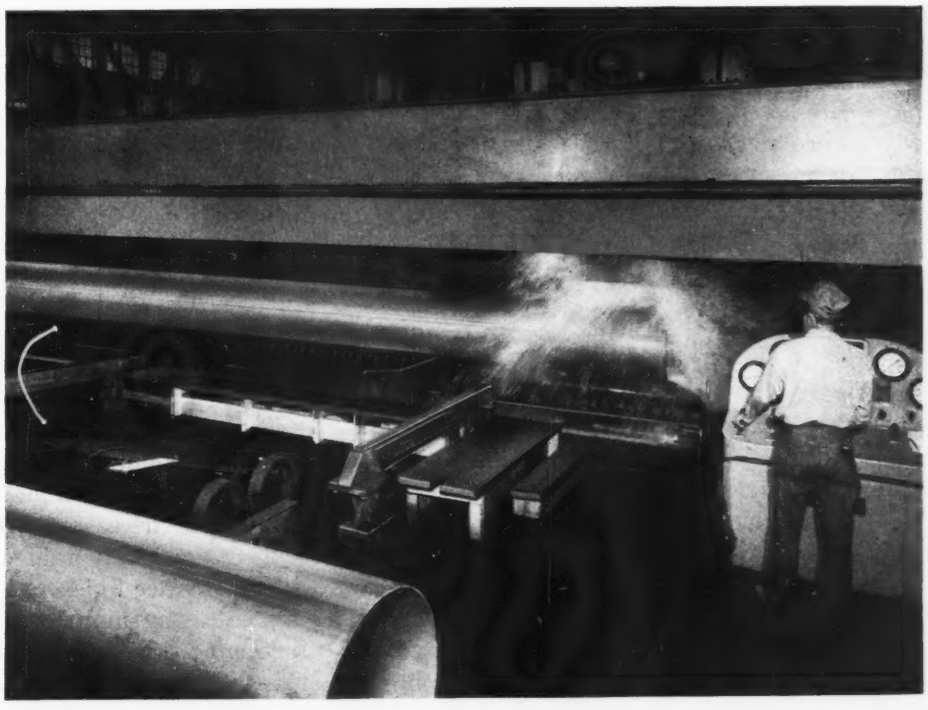
Much of the increased future steel requirements will be provided by using higher grade ores without material increase in blast furnaces.

Welded Steel Pipe Stretched to Size with Water

Electrically welded pipe produced in the new mill of the National Tube Co., McKeesport, Pa., (subsidiary of United States Steel Corporation) is brought to the specified outside diameter by expansion under water pressure. This operation, in which water is applied under a pressure as high as 3000 pounds per square inch, also adds to the strength of the steel. Pipes are stretched as much as 1/2 inch on the diameter.

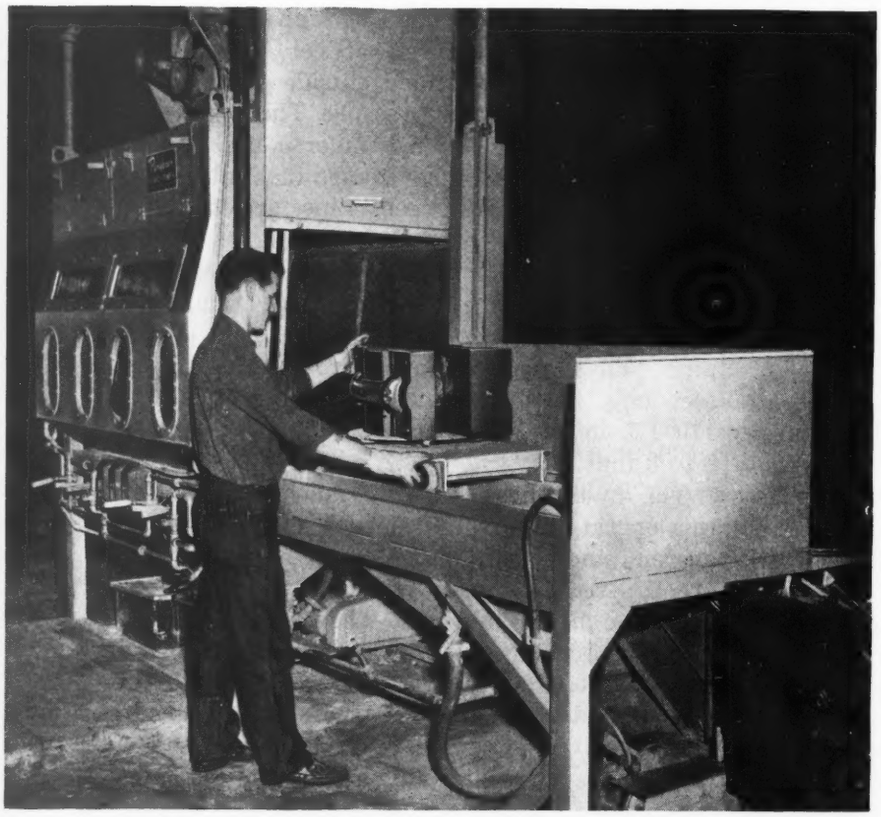
The illustration shows one of the pipe expanding machines at the end of an operation, with the water gushing out of the open end of the pipe. These pipes are made from plates 40 1/2 feet long, 1/4 to 1/2 inch thick, and 79 1/2 to 110 1/2 inches wide. Each plate weighs from 2 to 3 tons.

The hydraulic expanding machine used for this operation is equipped with a fixed plug on one end and a ram on the other, both of which are tapered to insure water-tight connections when the pipe is in place. The pipe is locked in a die during expansion, the die members being machined to limit the amount of stretch to the pipe diameter specified. As the pipe enlarges in diameter, it is, of course, reduced in length. The ram of the machine automatically advances to compensate for the reduced length of the pipe and maintain a tight seal on the pipe ends. When the pipe has reached the required diameter, the water pressure is reduced and the die opened, after which the pipe is tested and thoroughly inspected.



Water applied at pressures up to 3000 pounds per square inch is employed to stretch electrically welded pipe to specified outside diameters in National Tube Co.'s new pipe mill at McKeesport, Pa.

Liquid Blasting Cuts Cost of



Polishing of Die-Castings prior to Plating Can be Reduced by Reconditioning the Die Surfaces with Liquid Blasting. Time Required for Cleaning the Dies has been Reduced from Hours to Minutes, and the Surface Quality of the Die-Castings is Considerably Improved

By ALBERT G. LINTEL
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SURFACE quality of die-castings, particularly of castings that are to be plated, is of major importance in keeping finishing costs at a minimum. The surface finish of die-castings produced by the Precision Castings Co., Inc., Fayetteville, N. Y., has been considerably improved, and the time required for cleaning the die-casting dies has been drastically reduced by the application of the "Hydro-Finish" process to the reconditioning of the cavity surface of such dies.

"Hydro - Finish" is the name applied to a method of liquid blast cleaning by the Pangborn Corporation, Hagerstown, Md., manufacturer of the equipment employed for the process. In this process, a very fine abrasive, suspended in a liquid, is delivered to a blasting nozzle by means of a circulating pump. Velocity is imparted to the abrasive-charged liquid as it flows through the blasting nozzle by the injection of compressed air. The operator directs the blast of liquid and abrasive on the die to be cleaned, which is mounted in a water-tight cabinet.

The rapid cleaning action obtained with this type of liquid blasting substantially reduces the time required for reconditioning the cavity of the dies. For example, a die-casting die having a cavity approximately 8 inches long by 4 inches deep, made from a close-grained, air-hardening die steel that has been heat-treated to a Brinell hardness of about 444, can be cleaned in from five to ten minutes with this method, whereas, from three to four hours of laborious hand stoning and polishing was previously required. Also, grinding lines produced in the manufacture of the die can be blended, thus saving many hours of polishing time. The fine, high-pressure blast reaches even the most intricate sections, and disassembly of the die is seldom necessary.

With the "Hydro-Finish" process, the surface of the die cavity is given a microscopic, etched appearance. This non-directional, satin matte finish is most satisfactory for die-casting, being preferred to the bright surface previously obtained by means of hand-stoning. It has been found that the break-in time of a cold die, either new or reconditioned, is less when the die has been subjected to liquid blasting, fewer rejections being necessary before a satisfactory die-casting finish is obtained.

The surface finish produced on die-castings is influenced by many factors, including the surface condition and temperature of the die, the pressures employed, the production desired, and

Reconditioning Die-Casting Dies

the quality and temperature of the metal being cast. It has been general practice to polish and then buff die-castings that are to be plated. With the improved surface finish obtained on die-castings produced in liquid-blasted dies, polishing is no longer required, except on parting lines, the parts being only buffed prior to plating. Also, the plating seems to bond or adhere more readily to a die-casting finished in this way.

Since the quality of surface finish will decline the longer the die is employed to produce castings, it is imperative that the die be reconditioned periodically. The number of parts cast before die maintenance is necessary will vary with the size and intricacy of the die-casting, and depends on the subsequent finishing required. Dies employed for average size castings that must be plated have to be cleaned about once a week, while dies producing castings that do not need a finishing operation may be used for months before reconditioning is necessary.

A good indication of the need for die reconditioning is the appearance of either the die or the die-casting. When the die needs cleaning, carbon deposits adhering to the die can be felt by rubbing the fingers on the part. Also, as soon as the die starts to show oxidation or scale, cleaning is necessary to prevent the surfaces of the die-castings from becoming rough.

As seen in the heading illustration, the large "Hydro-Finish" cabinet is so designed that two operators can blast a large die simultaneously. Working space within the water-tight cabinet measures 6 feet long by 3 feet wide by 3 feet high. Dies weighing as much as 2 tons can be handled in this machine. The pump employed to circulate the abrasive-charged liquid is driven by a 1/2-H.P. electrical motor. A 2-H.P. motor-driven exhaust fan is used in the ventilating system to remove the fog created during blasting. Each of the two blast guns requires 47 cubic feet per minute of compressed air at a pressure of 80 pounds per square inch.

A die employed for casting wringer covers for washing machines from zinc alloy is shown in Fig. 1 being loaded on a rotary table in preparation for blasting. The hand-operated rotary table, which facilitates changing the position of the work during liquid blasting, is mounted on a portable car or dolly, which can be pushed by hand along tracks into the blasting chamber, as seen in Fig. 2.

After lowering the loading door at one end of the cabinet, the operator places his arms through the gauntlet-covered arm-holes at the front. Holding and directing the blasting gun with one hand (Fig. 3), the operator can swing the rotary table and die to any desired position with the other hand. The blasting operation can be observed in the lighted cabinet through windows provided at eye height in the front. A washing system keeps the window clear of spray from the blasting liquid.

Each blasting gun is equipped with two lengths of flexible hose, one for feeding the abrasive-charged liquid and the other for air

Fig. 1. Die-casting dies to be cleaned by liquid blasting are placed on the hand-operated rotary table of a portable dolly which carries them into blasting chamber

Fig. 2. Loading door of the "Hydro-Finish" cabinet has been left open to show position of the dolly and work during blasting

Fig. 3. Close-up view of the blasting operation. Gun is held in the operator's right hand while the work is positioned with the left hand

supply. The liquid flows through the gun nozzle continuously, and, when the knee-operated control valve is pushed to the right, compressed air is injected into the nozzle to impart high velocity to the stream. Although the maximum air pressure of 80 to 100 pounds per square inch is generally employed for all blasting operations, this pressure can be reduced by opening the valve only part way. A second knee-operated control valve, at the left, controls the spray of water to wash the window.

The blasting gun nozzle has an orifice 1/2 inch in diameter. Ordinarily, the end of the nozzle is held 3/4 inch to 2 inches from the surface of the die being cleaned. At this distance, the spray fans out to approximately 5/8 inch in diameter at the surface of the work.

The time required for cleaning a die varies with the size and design of the die, the condition of its surface, the mesh and hardness of the abrasive employed, the concentration of abrasive in solution, the condition of the abrasive, the air pressure, the distance the gun is held from the work, and the angle at which the gun is held with relation to the work surface. Cleaning time varies from about five minutes for the smaller dies of simple design to a maximum of thirty minutes for large, complex dies.

More time is necessary as the depth and intricacy of the cavity increase. In fact, dies having very deep cavities, recesses, or cores have to be turned upside down to insure cleaning all surfaces. Also, the longer the die is used before cleaning, the longer the time required to remove all oxidation from its surfaces.

Considerable experimentation is necessary to determine the proper size of abrasive to be employed. Since the abrasive particles are suspended in water, there is no limit to the fineness of the particle that may be used. Abrasive as coarse as 100 mesh and as fine as 5000 mesh can be used satisfactorily. The finer-mesh abrasive, although it has a higher initial cost and slower cleaning action, produces a smoother finish on the die surfaces, and there is no breakdown of sharp edges or corners. With such fine abrasive, the cutting action of the abrasive on the hardened steel die is negligible, and dimensional tolerances of precision dies can be maintained within 0.0001 inch.

On the other hand, coarse abrasive, although costing less and having a more rapid cleaning action, produces a rougher finish on the die surfaces. With any abrasive, the original geometric shape of the die cavity is maintained. However, inaccuracies cannot be corrected, and pits in the surface of the die cannot be removed.

Starting with a 1200-mesh abrasive and pro-

gressively increasing the abrasive particle size with successive cleanings, it was found that a 325-mesh abrasive was the most suitable and economical for cleaning operations of the type described. Although any type of non-metallic, commercial abrasive can be used, the company is employing Pangbornite, an abrasive supplied by the Pangborn Corporation. Pangbornite is an almost pure silicon dioxide known as novicite.

The amount of abrasive in solution is carefully maintained between 25 and 35 per cent by volume. Periodic inspections are made, and abrasive is added when necessary. Black streaks appearing on the die during or after the blasting operation indicate that the edges of the abrasive particles have become rounded and are no longer cleaning properly. When this happens, the machine is drained and cleaned and a fresh charge of abrasive and water is made up.

Approximately 80 pounds of the 325-mesh abrasive is required for a new charge with 25 per cent concentration. Rust inhibiting chemicals and water softening agents are also added to the water; the latter tend to keep the abrasive particles from packing into a hard mass when the machine is not in operation. With the present production, operating the "Hydro-Finish" cabinet from three to six hours a day, it is only necessary to change the abrasive solution about once a month.

When the machine is in operation, part of the blasting liquid is always being circulated directly from the hopper tank and through the gun by means of the pump. The liquid then drains back into the hopper tank to be recirculated. The remaining liquid is by-passed back to the hopper tank for circulation. When the machine is stopped, the abrasive will settle out of suspension. To prevent operational difficulties in restarting, the pump is protected by a special piping arrangement. Practically no wear of pump or nozzle parts has been encountered.

When the liquid blasting operation has been completed, the door is lifted and the car carrying the work is pulled from the cabinet. Abrasive and foreign matter is rinsed from the die surfaces by a stream of water to which rust inhibitor has been added (Fig. 4). The die is then blown dry by directing a stream of compressed air on its surfaces.

A die is seen at the top in Fig. 5 before cleaning, and at the bottom after liquid blasting, rinsing, and air-drying. From fifteen to twenty minutes is required to clean completely each half of the die in this way, whereas from six to eight hours of hand work was previously required. All dirt and oxidation are removed from the die surfaces, and a satin matte finish is produced.

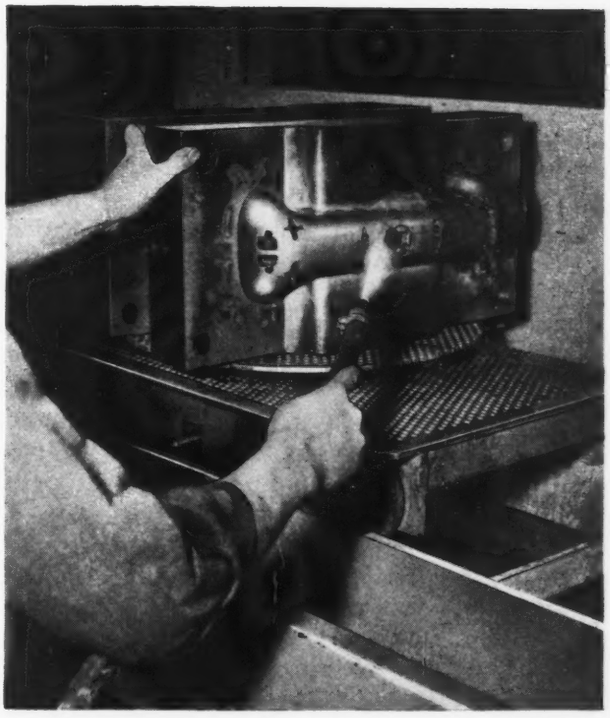
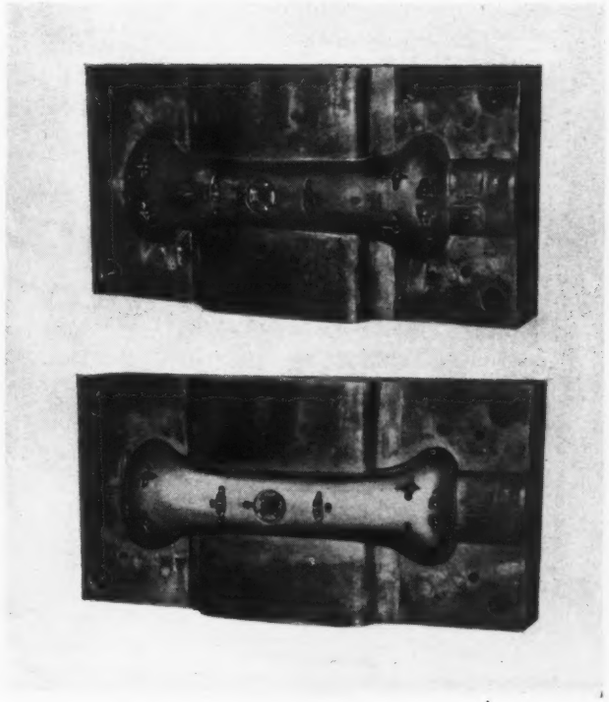


Fig. 4. After liquid blasting, it is necessary to rinse abrasive and foreign matter from the surfaces of the die before it is put back in use

Fig. 5. (Top View) Die-casting die before it has been reconditioned by liquid blasting, and (bottom view) die after it has been cleaned



The same process has been used extensively for removing similar deposits and hardening scale from glass, plastic, and rubber molds, and forging dies. Other uses of the "Hydro-Finish" process include the removal of small burrs from accurately machined parts, the improvement of lubricant-retaining properties of surfaces, decorative finishing of parts, finishing of graduated dials or scales to reduce glare and improve readability, removal of heat-treating scale and discoloration, preparation of surfaces for electroplating and other coatings, finishing of threaded sections for smooth close fits, mold manufacture and maintenance, improvement of cutting tool life and appearance, and general maintenance cleaning.

* * *

During a great surge of output in April and May of this year, steel companies for the first time in history were pouring more than 1,900,000 tons of steel a week. They held their production at that high level for over six consecutive weeks. That was more steel produced in a week than many countries make in an entire year. For example, it was more than the 1949 individual output of Australia, Sweden, or India. This high production reflected general business activity.

Machine Tool Selling Again Studied at Cornell and Purdue

The sales conferences that have been sponsored by the National Machine Tool Builders' Association and the American Machine Tool Distributors Association for the last three years were held this year at Cornell University, Ithaca, N. Y., July 31 to August 4, inclusive, and at Purdue University, Lafayette, Ind., August 21 to 25, inclusive. Ninety-eight salesmen registered for the Cornell conference, and 114 for the sessions held at Purdue.

The various sessions consisted of lectures pertaining to selling techniques which were made by men prominent in machine tool building and selling, as well as by faculty members of Cornell, Purdue, and Western Reserve Universities. Discussions followed the lectures. "Machine Tool Selling," by Professor Harry J. Loberg, was used as a text-book.

* * *

The volume of business in the gearing industry, as represented by members of the American Gear Manufacturers Association, showed an increase of 10.4 per cent in June this year compared with the previous month.

Participants in the sales conferences held at Cornell University under the sponsorship of the National Machine Tool Builders' Association and the American Machine Tool Distributors Association. Seated are some of the conference lecturers: Charles M. Clark, Cincinnati Milling Machine Co.; Swan E. Bergstrom, vice-president, Cincinnati Milling Machine Co.; Professor Harry J. Loberg, Cornell University; E. J. Seifreat, president, Seifreat Elstad Machinery Co.; and Tell Berna, general manager, National Machine Tool Builders' Association

Reproducing Drawings to Meet Increased Production Demands

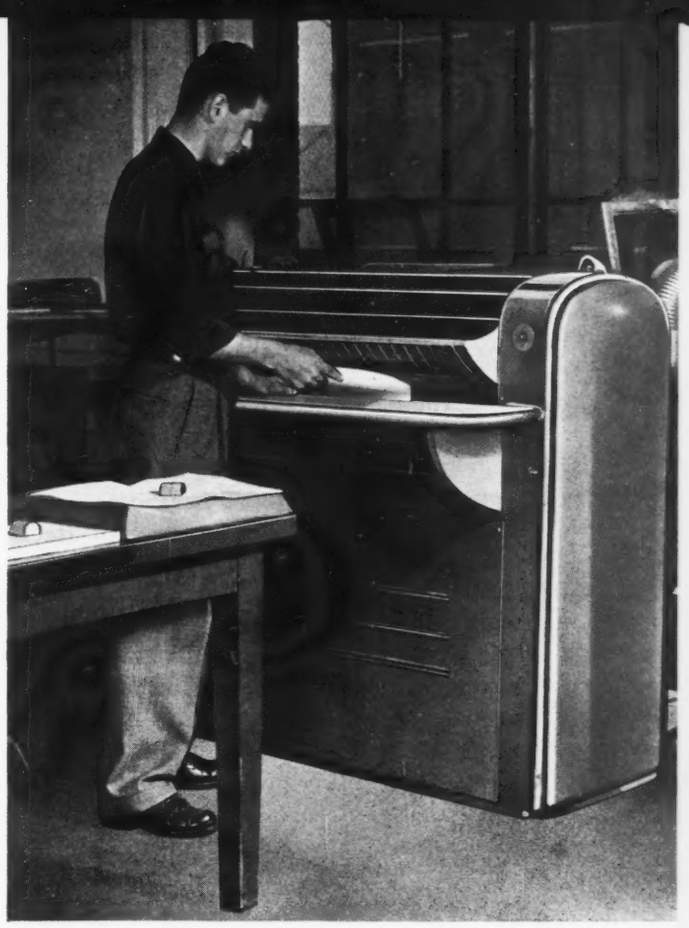
By F. S. DUNHAM
Supervisor Cab Division, Contract Department
Otis Elevator Co., Harrison, N. J.

PRODUCTION demands affect the engineering department and the drafting-room of a manufacturing plant in much the same manner as they do the rest of the shop. For example, increased production often makes it necessary to produce new drawings, change old ones, and make prints of one kind or another as quickly as possible.

In the contract department of the Otis Elevator Co., Harrison, N. J., hundreds of prints are made every day to supply the shop with specifications for elevator components of all kinds. Inasmuch as there are seldom two elevator installations that are alike, this department must constantly prepare new drawings and change old drawings of such elevator components as hollow metal doors, metal cabs, bi-parting freight elevator doors, and numerous other parts that change in design with each installation.

The reproduction of new and revised drawings is accomplished in this plant with the Ozalid "Streamliner" shown in the heading illustration. This machine, made by the Ozalid Division of the General Aniline & Film Corporation, Johnson City, N. Y., permits the use of a system that considerably expedites the supply of specifications to the shop. First, a master original drawing of a particular component is made and a sepia intermediate print produced from it on translucent paper. This intermediate print then becomes the reference drawing from which subsequent blue-line prints are made for the shop. The original drawing is filed away and only referred to or changed when the basic design is revised.

When special revisions are required, or when a new order permits the use of an existing design by making slight alterations, the sepia intermediate print is quickly changed by applying a solution to the section to be revised. This removes the lines at that section, which is then redrawn, leaving the rest of the design untouched. Blue-line prints are made from the corrected print for manufacturing purposes as before. In this way, corrections and new shop drawings for special jobs are quickly made without erasing or redrawing the original.



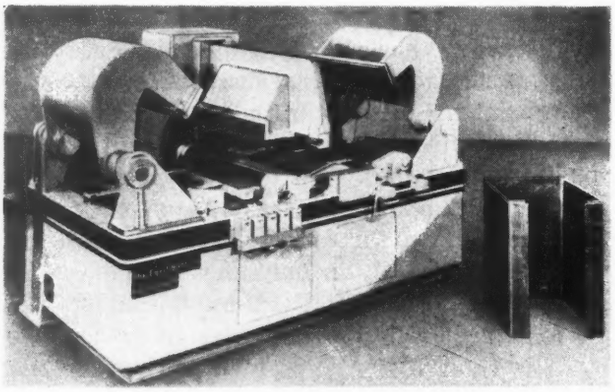
Another method of making quick changes when large areas of an original drawing are obsolete is to print the original in the usual manner, but without developing it. This results in a print having yellow lines. The lines to be retained are covered with a mask of black opaque paper. The print is then run through the machine again, and after developing it, the only lines reproduced are those that were masked from the light. The changes required by the new design are made on this print, and the altered print is then used for making blue-line prints for the shop.

The speed of the Ozalid "Streamliner" has been found particularly useful for jobs such as the design of extruded aluminum panels and a canopy for a special elevator, where over 50 drawings and 300 prints were made in thirty days. Present plans for the construction of wooden elevator cabs will require an increasing number of drawings.

When a great many prints of one drawing are required, two or three intermediates are made and these are fed through the machine with blueline paper, one after another. In this way, reproductions are made two or three times faster than when one original is employed. At present, this reproduction machine is in continuous operation, producing an average of 300 to 400 prints a day. It is also used extensively in the contract department for reproducing typewritten specifications for the shop, minutes of meetings, and other reports that are distributed widely.

Tangent Bender Forms 125 Washing Machine Cases per Hour

A four-wing tangent bender was recently developed by the Cyril Bath Co., Cleveland, Ohio, for producing the outer cases of automatic washing machines. In operation, blanked and punched sheets are fed endwise into a clear space in the center of the machine. In the first of a series of automatic operations, the center ram and two rocking, hold-down pads, shown in an upright position at the right and left of the machine, descend simultaneously to hold the sheet in place. This is immediately followed by the action of two end wings, which bend the ends of the blank up at the proper radius, and retract. The two hold-down pads then swing up, out of the way, allowing two concealed wings to move up and bend the front corners of the cabinet. After these two corners have been bent, the wings withdraw, and the center ram, carrying the forming die, is raised. At the same time, the punch collapses, and the finished shell is unloaded. This series of fifteen movements can be



Four-wing tangent bending machine that produces washing machine cases at high speed

manually controlled, but is normally automatic and operated through an electric control panel at the rear of the machine.

The production is 125 cases per hour. The machine is so designed that an overhead arm can be bolted in place to provide welding devices, so that the entire case can be formed from a flat sheet, welded while in the machine, and then unloaded.

* * *

Production of welding wire in the United States in 1949 was 352,668,000 pounds—a reduction from the peacetime peak of 467,986,000 pounds in 1948, but still substantially higher than the output of 237,780,000 pounds in prewar 1940.

Gear Life Increased 600 Per Cent by Improved Material and Design

The service life of the pinion and driving gears for the main drive of a 17-foot continuous billet mill in a large eastern steel mill has been increased from three months to over two years by improved material and design. Under existing operating conditions, it was impossible to flood the gearing with sufficient lubricant to carry off the heat generated by the transmitted load, and because of this situation, the material on the active contour of the gear teeth frequently was raised to a dull red heat. Furthermore, the gear teeth were subjected to the severe abrasive action of mill scale.

With the mill operating twenty-four hours a day, the standard 14 1/2-degree involute teeth regularly failed in approximately three to four months of service. Although these teeth were hardened by carburizing and quenching, the metal at the root of the teeth was worn away to the point where reversal of the gearing was impossible.

Production engineers at the mill selected the Stroh process of casting as a possible solution to the problem. This process, developed by the Stroh Process Steel Co., Pittsburgh, Pa., produces castings having a high grade alloy steel surface and a base metal of plain carbon steel. The result is a tough, wear-resistant austenitic steel surface on a low-cost, cushioning layer of carbon steel, which is easily machined for mounting on the shaft.

A change in design was also made by substituting 20-degree involute long and short addendum teeth for the standard 14 1/2-degree involute teeth. The new design made possible a smoother running gear drive, with less tooth chatter and strain on the bearings. Gears made in this way have given approximately one year's service before reversal and one year's service after reversal—an increase of between 600 and 800 per cent over the gearing that was formerly employed.

* * *

Transforming old railroad rails into useful products, such as fence posts, bedsteads, clothespoles, wheelbarrow handles, and playground equipment, keeps about twenty mills busy in the United States and Canada. The old rails are not re-melted. They are heated to rolling temperature in a furnace and then are sliced into three parts—the head of the rail; the web or middle part; and the flange or base. Each of these sections is then rolled to the required size and shape.

Interchangeable Tooling Applicable to Wide Range of Work Sizes

Tooling and Methods Employed in the Production of an Extensive Series of Lead-Bronze Lined, Steel-Backed Bushings

Fig. 1. A few of the nearly 180 sizes of bushings that are formed from copper and lead-bronze coated steel strip stock

INTERCHANGEABLE tooling that can be used for a series of press operations in the manufacture of nearly 180 sizes of bushings has been developed by the Glacier Metal Co., Ltd., Alperton, England. The degree of interchangeability of this tooling lay-out permits many of the tools to be used for all sizes and others for groups of sizes. Such a lay-out reduces the tooling costs to a minimum, thus decreasing the cost of the product, and also enables rapid change-overs in production to be effected.

The bushings, a few of which are shown in Fig. 1, consist of a steel shell, formed to a cylindrical shape and lined with a lead-bronze alloy which is applied in powder form and firmly bound to the steel by a sintering process. The periphery of the bushing is provided with a thin copper coating. A hole is pierced and grooves are machined in the bushing to permit either oil or grease lubrication to be employed. Each standard bore size—from 3/8 to 1 inch, varying by 1/32-inch increments, and from 1 inch to 2 1/4 inches, varying by 1/16-inch increments—is made in from four to seven lengths. The thickness of the steel shell varies with the bushing size from 0.030 to 0.070 inch, and the lead-bronze lining is from 0.016 to 0.023 inch thick.

The material is delivered to the press room in the form of coiled strip with copper on one side and the lead-bronze coating on the other. In the first operation, the strip is fed from the coil, with the lead-bronze side up, through guides *A* on an inclinable press, as shown in Fig. 2. The spacing between the guides is adjustable to handle different strip widths.

The tools used for this operation are shown disassembled in Fig. 3. The oil-hole is pierced by an inserted punch in the upper tool *B*, and the oil-grooves are formed in the lead-bronze coating by projections on tool *B*, (shown inverted in Fig. 3) as it descends with the press ram. When the ram reaches the bottom of its stroke, the trademark and part number are stamped in the lower copper surface of the strip by the inserted punches *C*. These punches, which are mounted in member *D*, are interchangeable and adjustable for depth of impression.

As the ram rises, the strip is fed into the press until it comes in contact with an adjustable stop *G*, which is mounted on a bar at the rear of the press. With the strip thus located, punch *E* severs the blank that was pierced and grooved on the previous stroke of the press. This punch cuts on three sides only, as the sheared edge across the end of the strip that is produced when blanking the previous part also forms one edge of the next part. There is, therefore, no scrap between the blanks.

The three-sided blanking die opening is formed by members *D* and *F*, which are shown in their approximate relative positions in Fig. 3. The spacing between blanking die members *F* can be adjusted, and as these members are of sufficient depth from front to rear to handle the longest bushing, they can be used for the end trimming of all blanks.

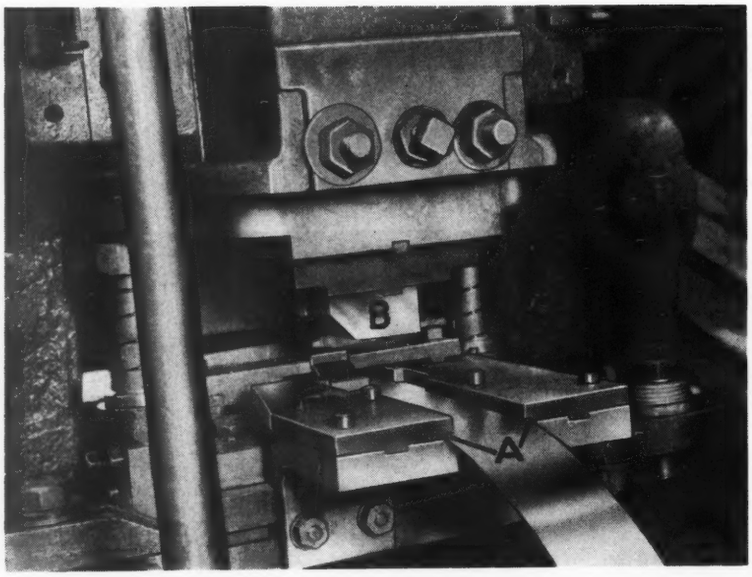


Fig. 2. The first press operation in producing the bushings is piercing, grooving, and blanking of the strip stock

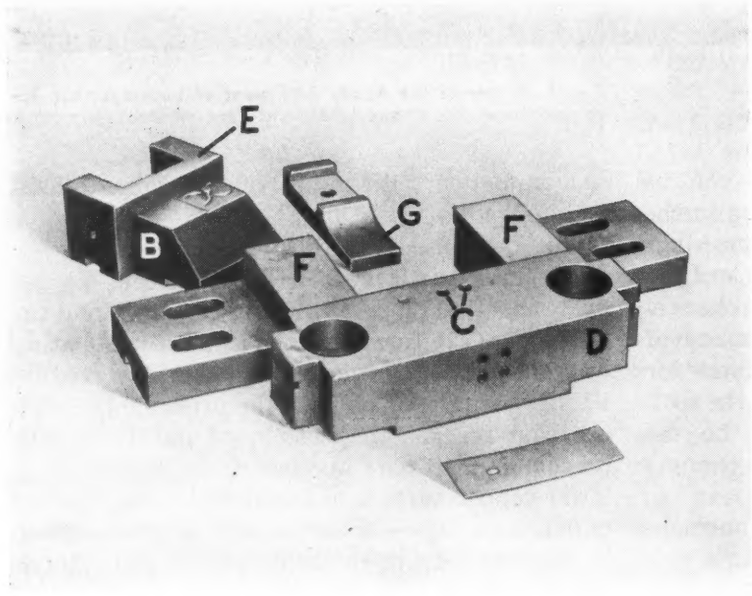


Fig. 3. Disassembled tools used for the press operation shown in Fig. 2. A three-sided blanking die opening is formed by members (D) and (F)

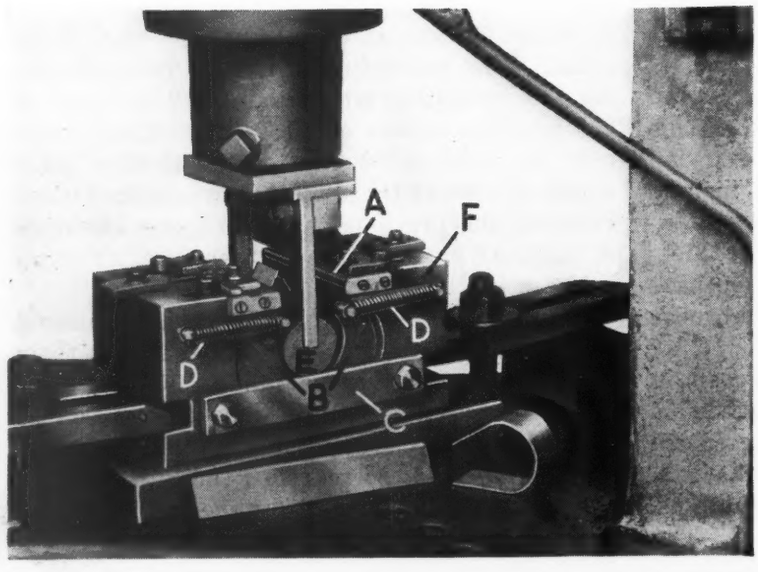


Fig. 4. Set-up for the first bending operation on the bushing. The flat blank is positioned in a nest formed by adjustable locators that are mounted on top of tool

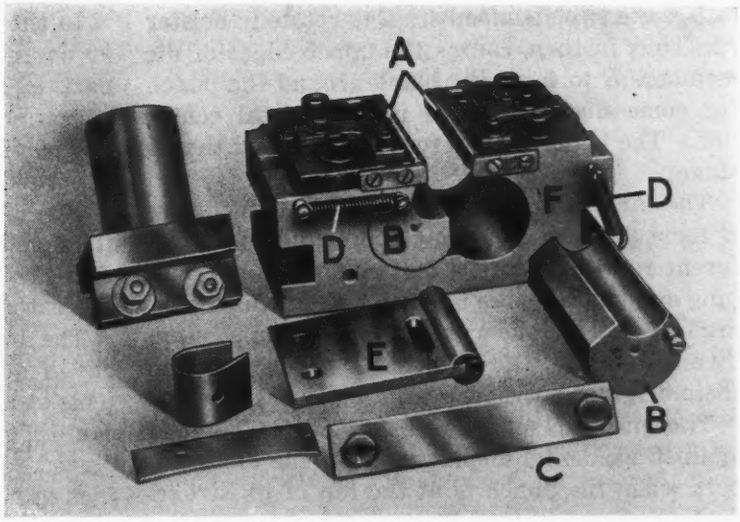


Fig. 5. Details of the tools used for the bending operation shown in Fig. 4. Die members (B) are rotated in bolster (F) by action of punch (E)

The only scrap produced is the two narrow strips resulting from the trimming of the edge. These strips pass through the guides to the rear of the press, where they are sheared at each press stroke and fall into a container. The work blanks drop through the die and down a chute to a second container located at the rear of the press.

Punch *E* can be used for only one diameter of bushing, but it can be employed for different lengths of bushings having the same diameter. The length is determined by the amount the stock projects beyond the edge of member *D* at the blanking stroke, and this depends upon the setting of stop *G*. Punch *E* is hollowed out on the under side to allow stop *G* to be advanced sufficiently to produce short bushings.

In order to maintain symmetrical bushings, piercing and grooving tools *B* and *D* can only be used for one length of bushing. They can, however, be used for small groups of bushings having the same length but different diameters, provided the oil-holes and oil-grooves are the same for each bushing in the group. It is, of course, necessary to substitute the appropriate part number marking punch when changing production from one size to another.

For the first bending operation, the blank is placed, with its lead-bronze side up, on top of the die shown set up on a press in Fig. 4 and disassembled in Fig. 5. The blank is positioned in a nest formed by several adjustable locators mounted on top of the die, so that any length or width of blank within the complete range can be accommodated. The ends of the blank are purposely bent unsymmetrically by locating the blank slightly off center, for reasons that will be explained in connection with the subsequent coining operation.

As the punch *E* descends, it draws the blank over the two rollers *A*, which insures free movement of the part and also prevents scoring of the copper coating on the under side of the blank. As the punch reaches the bottom of its stroke, it

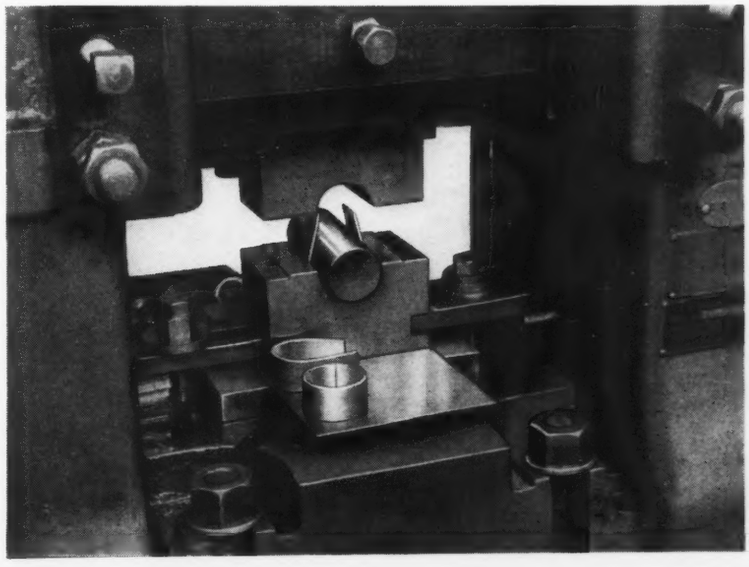


Fig. 6. The bent strips are formed to the circular shape required for the bushing by two strokes on a 150-ton knuckle-joint press, as here illustrated

causes the two die members *B* to rotate in bolster *F*. This, in turn, causes the upper edges of die members *B* to force the blank around the punch for some distance above its horizontal center line. The blank is therefore bent beyond the U-stage.

The inner and outer surfaces of die members *B* form parts of two eccentric cylinders of different radii. They are located in two overlapping cylindrical bores in bolster *F*, in which they are free to turn, and are only retained in position by end plate *C*. Die members *B* are returned to their original position by the punch as it rises.

The springs *D* serve as a safety device to guard against accidental displacement of the die members when the punch is at the top of its stroke. A clearance slot is cut through the center of the punch carrying plate directly above the cylindrical punch *E* to allow the ends of the blank to be brought close together at the bottom of the stroke. There is sufficient spring in the material to insure that the edges will clear the plate and punch when the ram rises, so that the work can be easily stripped. Punch *E* and die members *B* are the only parts that must be changed when a different size bushing is to be produced.

The bent strips are formed to the required circular shape on a Bliss 150-ton knuckle joint press, Fig. 6. Guards and the automatic feed attachment have been removed in this illustration, as in Figs. 2 and 4, for clarity. The formed blanks from the previous operation are snugly fitted on a mandrel and so positioned on the die that the gap between the ends of the blank is approximately bisected by the vertical center line of the punch. The punch and die are semi-cylindrical, and the work is formed to size and coined between the tools and mandrel.

After the first stroke of the press, the mandrel is turned through approximately 90 degrees, and the part is subjected to a second pressure to insure that all parts of the periphery are subjected to the coining action.

In the finished bushing, the oil-hole is located 90 degrees from the joint. For this reason, the part is not bent symmetrically in the second operation. If it were, the oil-hole would lie on the parting line of the coining tools, where the effect would be to shear any burr on the outside of the hole and leave a blemish on the part. With the hole slightly above or below the parting line of the coining die, the burr is eliminated by coining rather than shearing.

The bushings are next faced and chamfered on an automatic machine using carbide-tipped tools at a production rate of 700 per hour. They can then be precision-bored or reamed if required. Usually, however, the bores of the bushings are simply finished to size with burnishing tools after assembly.

* * *

Telescope Ascension Gears Require Precise Machining

Precise spacing of the teeth of telescope gears is essential to permit the telescope to "track" and hold stars motionless on photographic plates for hours at a time. As conventional methods are unsuitable for cutting such gears, the "gash" method and special equipment are employed by the Warner & Swasey Co., Cleveland, Ohio, to produce these parts.

Several days were required to cut the 720 teeth of the 7-foot diameter ascension worm gear shown in the accompanying illustration. The gear was used in the new University of Michigan's 24-inch, Schmidt type telescope, which is the sixty-eighth equatorial telescope built by Warner & Swasey.

Each tooth of the gear was cut separately, with a circuit of roughing cuts being followed by the finish cutting of consecutive teeth. In finishing, only a few thousandths of an inch of stock was removed. The gear was correctly positioned for each of the cuts by microscope alignment of graduations on a finely divided circle. The circle was produced on a 40-inch automatic dividing machine designed and built by Ambrose Swasey over 50 years ago. This machine is one of the most accurate in existence, with a maximum error of only 1 second of arc.

Special machine employed to accurately cut 720 teeth on telescope gears

Norton Establishes School of Grinding

A fully equipped grinding school has recently been established by the Norton Co., Worcester, Mass. Staffed by its own men, who have been selected for technical teaching ability and practical knowledge of grinding techniques, the school offers both the theoretical and the practical approaches to the uses of abrasives and the art of grinding.

The school is designed to teach the practical application of grinding and allied abrasive processes to the company's own sales trainees and plant supervisory personnel, to its distributor salesmen (both domestic and foreign), to customer personnel, and to instructors in grinding from engineering, trade, and vocational schools.

Thirty pieces of grinding equipment were required for the work-shop. The aim of the school is to give individual instruction as nearly as possible, and with this end in view, an attempt is made to restrict the number of trainees in a class to not over twelve. Depending on the requirement of the group or individual under instruction, courses range from one to fifty-five weeks.

Nearly all courses begin with a plant tour. The instructors of the school then take over and conduct class-room training and discussion periods. Lectures by abrasive, grinding machine, and research specialists, the use of Norton Co.'s own training film library entitled "Lessons in Grinding," live demonstrations, and actual practice by the trainees round out a typical program.

Courses cover all types of grinding, including cylindrical, surface, internal, centerless, tool and cutter, cutting-off, disk, rough, and free-hand grinding. Other subjects included are the properties of abrasives and bonds; precision tumbling; polishing; lapping; surface finishes; grinding of non-metals; injury in ground surfaces; grinding compounds; form grinding; safety, care, handling, and storage of grinding wheels; and activities of the research, development, and publicity organizations at the Norton Co.

A similar school is maintained by the Behr-Manning Corporation, the coated abrasives (sandpaper) manufacturing division of the company at Troy, N. Y.

* * *

Booklet on "Colorimetry" Available from Bureau of Standards

Scientists and technicians concerned with color measurement will find much helpful information in a new booklet, "Colorimetry," by Deane B. Judd, recently published by the National Bureau of Standards. Colorimetry is of vital importance in modern mass-production methods. The assembly of a complicated machine like a refrigerator, for example, often requires a color specification for each of several parts.

For the last twenty years, the National Bureau of Standards has played a leading part in establishing practical working standards of color and in setting up and administering color tolerances. As a result, conformity to a color requirement can now be determined with the same assurance as mechanical properties. The booklet just issued describes the standards and measurement methods developed by the Bureau in this field.

The booklet, designated Circular C478, is available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at 30 cents per copy.

* * *

Nickel is used in more than 3000 ferrous and non-ferrous alloys to impart one or more of its characteristics to these alloys. The percentage of nickel in the different alloys ranges from 99.7 per cent in malleable nickel to 0.20 per cent in a hardenable silver alloy.

Operation of a 6- by 18-inch surface grinding machine is demonstrated to trainees at new Norton school

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Severe Cold-Forming Possible with New Stainless-Steel Tubing

A new stainless steel that work-hardens much more slowly than conventional chromium-nickel steels is available in tubing form for applications requiring severe deforming, bending, or upsetting. This tubing, made by the Carpenter Steel Co., Union, N. J., is known as "Stainless No. 10" tube.

The analysis of the new material is: Carbon, 0.08 maximum; chromium, 16 per cent; nickel, 18 per cent. The tubing helps to overcome the manufacturing difficulties associated with the rapid work-hardening of conventional 18-8 stainless steels. The slow rate of cold-hardening of No. 10 compared with other stainless steels is indicated by the following tensile strengths of the different steels after a 50 per cent reduction: Stainless No. 10, 146,000 pounds per square inch; Stainless 305, 165,000 pounds per square inch; Stainless 304, 170,000 pounds per square inch; Stainless 302, 190,000 pounds per square inch.

The new steel is recommended for all tubular parts requiring severe forming, bending, spinning, coining, extruding, and upsetting. It can be brazed or soldered after being cold-worked. Among its applications are flexible hose, integral finned tube, heavy lapped Van Stone flanges with stub ends, spun end thermocouples, and electrical instruments. 1

Fast Curing Phenolic Plastics Increase Production Levels

The Bakelite Division of Union Carbide & Carbon Corporation, 30 E. 42nd St., New York 17, N. Y., has recently developed a new class of fast curing phenolic plastics, designated Bakelite C-22. The curing rates of these materials are said to be 45 per cent faster than those of phenolics previously regarded as fast curing. The new plastics have high gloss and excellent mold release characteristics, and are suitable for compression and plunger molding in positive or semi-positive molds. 2

Non-Spreading Oils for Precision Instrument Bearings

Two lubricants for use in fine precision instruments have been introduced on the market by the Gulf Oil Corporation, Pittsburgh, Pa. These lubricants, known as "special instrument" oil and "micro bearing" oil are synthetic products that have special properties which adapt them to the lubrication of small, delicate, low-torque bearings.

Both oils have practically none of the ordinarily desirable creeping or spreading tendencies found in petroleum oils. This non-spreading quality enables them to "stay put" over long periods of time when applied in minute quantities to small pivot-to-jewel or pivot-to-brass bearings. The oils are highly resistant to oxidation and are low in volatility, permitting their use over prolonged periods with a minimum of gumming or thickening. 3

Gas-Turbine Stator Blades with Aluminum-Alloy Roots

Bi-metallic gas-turbine stator blades having aluminum-alloy roots for easy machining are under study in England. The study is being conducted by Wellworthy Pistons, Ltd., holder of the British license from the Al-Fin Division of the Fairchild Engine & Airplane Corporation, Farmingdale, Long Island, for the molecular bonding of aluminum to steel by means of the Al-Fin process. The primary object is the development of a rapid, economical method of manufacturing compressor stator assemblies.

Bright-drawn steel strip is used for the airfoil section. The strip, which is furnished to extremely close dimensions by the mills, is cut to length, and an aluminum-alloy root is bonded to it by the Al-Fin process. The alloy used is selected for its corrosion resistance and strength. The immediate advantage of the method is that it provides a means of manufacturing compressor stator blades with a root section that is readily machinable, thus resulting in decreased costs.

To obtain additional information about materials described here, use Inquiry Card on page 217.

In addition, development is foreseen of compressor stator blade units made in segments containing a number of blades or even complete stage rings with blade sections made integral by bonding of the drawn airfoil strip steel. Cost and weight advantages are anticipated from such construction. 4

Anti-Corrosive Primer Applied Over Corroded Steel

"Tuf-On-Rust"—a new primer for corroded iron and steel—has been announced by the Brooklyn Varnish Mfg. Co., Inc., 50 Jay St., Brooklyn 1, N. Y. This primer is said to have superior anti-corrosive properties when applied directly over corroded surfaces. It dries in four hours, and can be applied by brushing or spraying. The new product is suitable for use in plant maintenance and on steel structures. 5

One-Coat "Hammer-Finish" Enamel for Metal Parts

A one-coat "hammer-finish" enamel, known as "Un-i-loid," which can be sprayed on metal parts has been announced by the United Lacquer Mfg. Corporation, Linden, N. J. One coat of the new enamel when sprayed at standard enamel pressure, produces a hammered effect, with a smooth, lustrous appearance. It is available in a full range of colors and in either a bake or an air dry finish. 6

Bonded Shim and Brazing Alloy Simplifies Carbide-Tip Brazing

Ordinarily when a carbide tip is "sandwich brazed," five pieces are fused together—the tool shank, a brazing alloy shim, a steel shim, another brazing alloy shim, and the carbide tip. "Bondwich," a product of the General Plate Division of the Metals & Controls Corporation, Attleboro, Mass., is a shim that combines the steel and brazing alloy in a single shim, reducing the problem of aligning five separate pieces to that of aligning only three pieces.

The use of this material is said to speed up the brazing of inserted carbide tips, reduce the danger of flux inclusions, and contribute to longer tool life. 7

Non-Melting Lubricant Developed for Industrial Use

"Plastilube," an all-purpose lubricant that is said to be non-melting, even at temperatures as high as 500 degrees F., is a recent development of the Warren Refining & Chemical Co., Cleveland, Ohio. This lubricant is said to possess high adhesive qualities, excellent pumpability at low temperatures, and resistance to breakdown. It is adaptable for a variety of automotive and industrial applications. 8

Coating That Protects Metal Against Salt Corrosion

A corrosion-resistant coating for metals has been announced by End-O-Rust, Inc., 1900 Euclid Ave., Cleveland, Ohio. Although primarily developed for use on metals, the coating is also applicable to concrete, wood, fiber, and other surfaces where more than normal protection is needed. Complete protection is achieved without dipping or heat-treating, and special preparation of surfaces is unnecessary.

"End-O-Rust" coating dries in two to three hours, and has a high, hard, glossy finish, impervious to abrasion. It is recommended for use in coastal areas, where dampness and salt air stimulate corrosion. The product is manufactured by the Benton-Climo Co. of Cleveland, Ohio. 9

Hot-rolled Inconel T-sections are now available, according to an announcement of the International Nickel Co., Inc. As produced at the Huntington, W. Va., works of the company, the T-sections are made in a standard size, 1 1/2 by 1 1/2 inches by 1/4 inch, and in lengths up to 15 feet. The weight is approximately 2 3/4 pounds a foot. The primary purpose of the new product is to provide manufacturers of furnaces and other high-temperature equipment with ready-made, uniform structural parts. The section can be welded, riveted, or otherwise joined without trouble.

To obtain additional information about materials described here, use Inquiry Card on page 217.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Machine Held for Cost of Repairs

A. C.—We sold a machine and nothing was said as to whether the sale was to be cash or credit. The buyer, after accepting delivery of the machine, took it to be repaired. Now he refuses to pay the bill. How can we get possession of the machine without paying for the cost of repairing?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

According to a recent higher court decision, anyone who has possession of a machine that belongs to another must apply to a Court for authority to keep it in his possession, or he will be held liable for damages.

In Mogul Transp. Co. vs. Larison [181 Pac. (2d) 139], the testimony showed that a certain man offered, by letter, to buy a specified used machine from a dealer "as is" for $4000. Nothing was said as to whether he would pay cash or buy on credit. Later the man was given possession of the machine by the seller. After considerable controversy, the seller wrote a letter to the buyer and demanded full cash, which he could not pay. Also, the buyer could not give possession of the machine to the seller because it was being held by a third party for money due on a repair bill. The seller sued both the buyer and the third party for damages.

This Court held that the buyer and the third party must pay the seller $5000 damages because, when the buyer took delivery of the machine, the law implied that he would pay cash. Also, neither the buyer nor the repairman had legal right to keep possession of the machine. The Court said: "In such a sale, payment and delivery are concurrent acts. Title to the property does not pass until payment, and, if the buyer has taken possession without paying the price, the seller may reclaim the property . . ."

With respect to the repairman, the Court held: "The repairman should have offered to bring the property into Court to abide its decision . . . Failure on the part of the repairman to offer to deliver it as the Court might direct and to take a Court order protecting him in his premises, had the effect of subjecting him to liability to damages for depriving plaintiff of the use of the machine." Therefore, you can compel the repairman to give up possession of the machine by applying to a Court for an order to that effect or you can sue and recover the machine, in addition to an adequate amount for damages.

Forming Sheet-Aluminum Parts

F. C. D.—Can you form sheet-aluminum parts with the same dies as are used for steel or other metals, such as copper and brass?

Answered by Reynolds Metals Co.
Louisville, Ky.

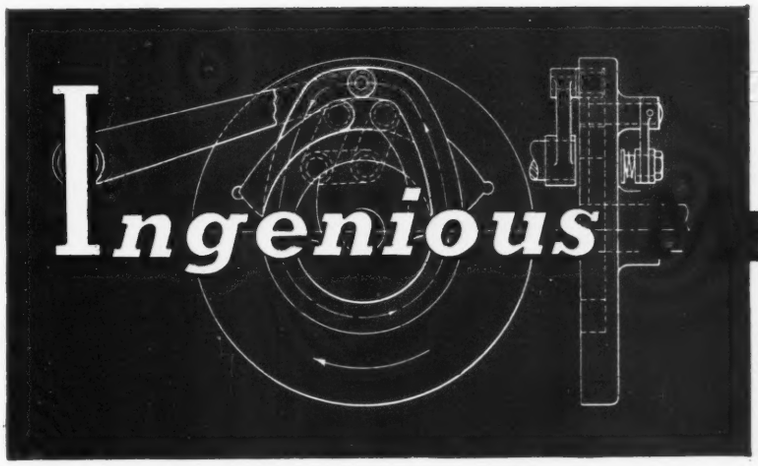
Yes, aluminum can be substituted for the same thickness of most any other metal, and blanked, formed, or drawn in the same dies as used for the other metal. This is an important feature, as it permits changing over a part or product directly to aluminum without necessitating new dies. However, in some instances, die radii and clearances may have to be modified slightly by reworking the dies.

When the aluminum part must have the same rigidity as the steel part, it is necessary to use a thicker blank. However, the same dies can still be used if the part is merely bent or formed, not drawn. When drawing is involved, it will be necessary to increase the die cavity by removing some steel from the die surfaces in order to allow the proper clearance between punch and die in the wall areas.

If satisfactory results are not obtained with the aluminum, it may be because the incorrect alloy or temper is being used, or the tool adjustment is not right. Remember the material may crack if too hard or buckle if too soft.

* * *

Up to 25 per cent more tire mileage can be obtained by rotating tires every 2000 to 3000 miles. Tire engineers report that the right rear tire generally gets 38 per cent of all tire wear; the left rear tire, 29 per cent; the right front, 19 per cent; and the left front, 14 per cent.



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Three-Speed Gear Conversion Unit for Bicycle Coaster Brake

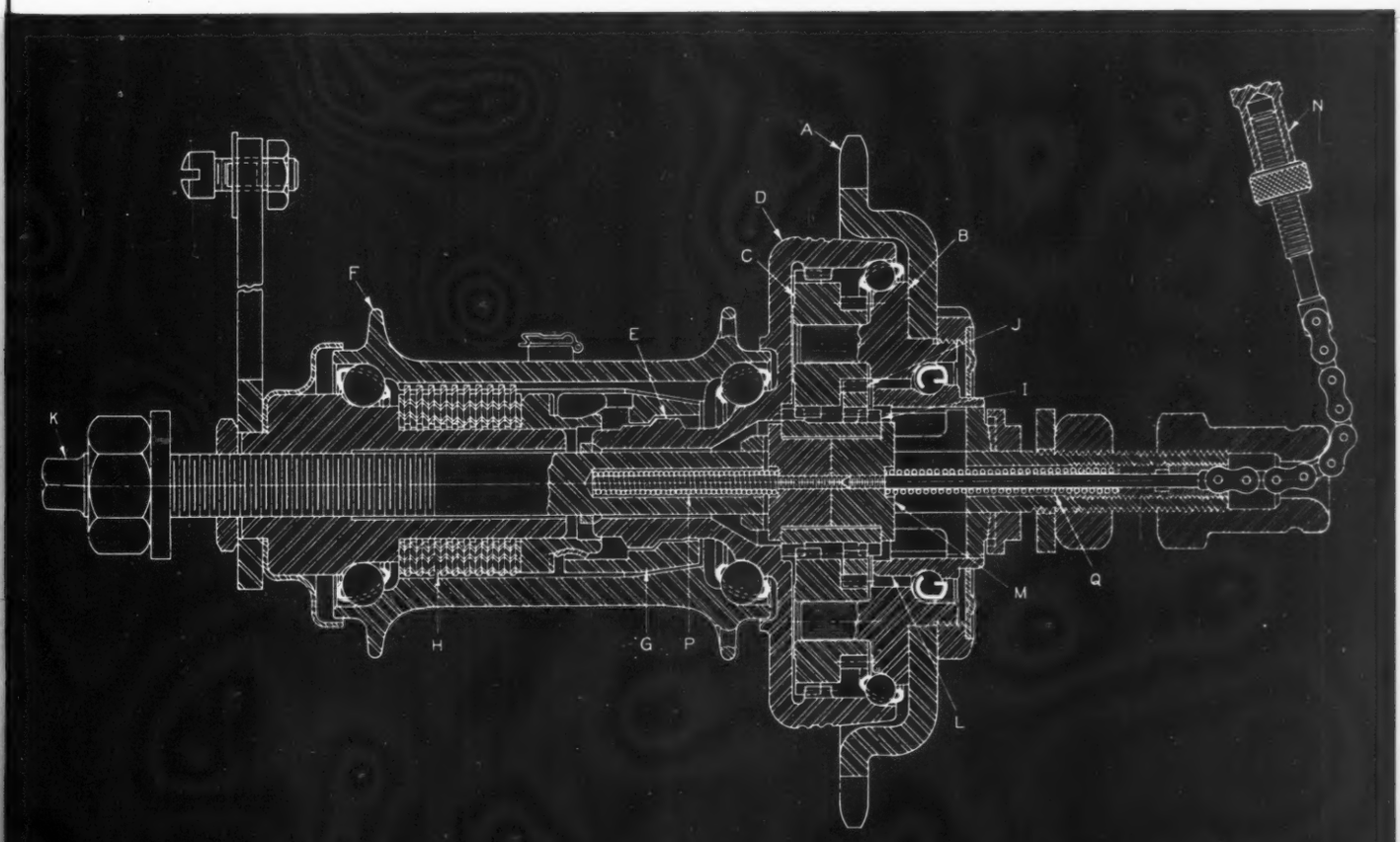
By S. F. MARINO, Engineer
New Departure Division, General Motors Corporation

A three-speed gear-change mechanism for a bicycle, designed to afford greater ease in pedaling, is shown in the accompanying illustration. The mechanism enables the rider to shift quickly to a low gear for climbing hills, for riding against a strong wind, and for riding over rough roads; to change to an intermediate gear for normal riding and for slight up grades; and to change to a high gear for riding on level ground or slight down grades, as well as for riding with the wind or at a fast speed.

The three-speed mechanism was designed by the New Departure Division of General Motors Corporation as a complete conversion unit for bicycles equipped with regular New Departure coaster brakes. This new unit is designated the "Triplspeed" to distinguish it from the two-speed New Departure coaster-brake unit brought out in 1937.

The three-speed mechanism, as shown in the illustration, is assembled on a shaft or axle *K*, which is simply inserted in the regular coaster-brake hub shell *F* in place of the original plain shaft and sprocket. The regular brake plates or

Cross-section view of "Triplspeed" coaster-brake mechanism



disks *H*, the ball bearings at each end of the hub shell, and sleeve *G* remain undisturbed. The brake can be applied when using any of the three speeds by simply back-pedaling in the regular manner.

Essentially, the "Triplspeed" unit consists of a sprocket *A* driven by the bicycle chain; a planet-gear carrier *B* to which the sprocket is attached; four compound or stepped planet gears *C* journaled on the planet-gear carrier studs; a ring gear *D* with which the teeth of planet gears *C* are constantly in mesh (The ring-gear driver *D* is made with a triple-thread extension *E*, which serves as a means of driving the hub shell *F* through the sleeve *G* or applying the brake by exerting pressure on the brake plates *H*.); a sliding sun gear *I* with a larger supplementary sun gear *J*; and an axle *K* to which an axle cone *L* is permanently fixed.

In low gear, the sun gear *I* rotates freely on the two-piece axle sleeve *M*. One set of sun-gear teeth *I* meshes with the teeth at the larger end of planet gears *C* and the other set of sun-gear teeth engages the internal teeth of supplementary sun-gear *J*, whose outer teeth mesh with the teeth of the smaller end of the planet gears. Since it is impossible for the stepped planet gears *C* to revolve about sun gears (*I* and *J*) of unequal diameters, the mechanism is locked and is driven as a unit about the axle, resulting in direct drive or low gear.

When the sliding sun gear *I* is moved outward, it disengages the supplementary sun gear *J* and immediately engages the internal teeth of the fixed axle cone *L*. Thus the sun gear *I* becomes stationary, allowing the planet gears *C* to revolve about the sun gear and cause ring gear *D* to revolve. This results in the first over-drive or normal gear.

When the sliding sun gear *I* is moved farther out and deeper into the fixed axle cone *L*, the teeth at its other end engage the internal teeth of the supplementary sun gear *J*, allowing the small planet gears *C* to revolve about the external teeth of sun gear *J*. The teeth at the larger end of planet gears *C* being made integral with the gear on the smaller end serve to drive the ring gear *D*. This results in the second over-drive or high gear.

The outward movement of the sliding sun gear *I* is accomplished by pulling the control cable attached to the coupling *N*. The cable is operated by means of the control shifting lever mounted in a convenient position on the handle bar. When the cable tension is released, the sliding gear is allowed to move inward, resulting in successive gear changes to normal and low gear. The gear changes are, therefore, from low to normal to high, and vice versa. The brake can be applied at any speed in the conventional manner. This three-speed drive is a true synchro-mesh transmission. The gears cannot clash during gear changes because the sliding sun-gear teeth always leave one set of mating gear teeth before entering another set. The gears are so designed that the sliding gear, regardless of speed, always engages its mating gear without lost motion and without clashing. Therefore, shifting may be done at any time.

Each gear change may be pre-selected. Pre-selecting of any of the three speeds may be accomplished, while driving, by shifting the control lever in advance. When the rider wishes to change gears, he momentarily stops pedaling. This releases the driving pressure, allowing the gear change to be made quickly and automatically by the actuating spring. Pedaling can then be resumed in the pre-selected speed.

Changing from one speed to another is done as follows: The position of the sliding sun gear *I* is predetermined by the movement of the two-piece sleeve *M* on which gear *I* is mounted. The two sections of sleeve *M* are backed up by two springs *P* and *Q* within axle *K*. With the sliding sun gear *I* under torque from pedaling, the shifting lever is moved to the desired gear change position. When the torque is removed from the sun gear by momentarily stopping pedal movement, the axle spring moves the sliding sun gear automatically to the predetermined position. Upon resumption of pedaling, the sliding sun gear has assumed its proper position and the unit is in the desired gear. Similarly, pre-selection may be accomplished from high to low, normal to high, or any other desired combination.

One of the most attractive design features of this drive is that the shifting control-lever assembly is located near the handle-bar grip. Shifting of gears is done without the necessity of removing the hand from the grip. Shifting from low to normal to high is done by pulling up on the shifting lever with the fingers. Shifting from high to normal to low is accomplished by pushing down on the release lever with the thumb.

The calculation of the bicycle "gear number" is as follows: The bicycle "gear" is an indication of the distance traveled by the bicycle per revolution of the pedal crank or front sprocket. The "gear number" multiplied by 3.1416 equals the distance covered in one revolution of the front sprocket. Thus a bicycle having a 69 gear travels 216 inches, or 18 feet, along the road for each crank revolution.

The "gear" of a bicycle is the product of the number of teeth in the front sprocket and the

number of inches in diameter of the rear wheel divided by the number of teeth in the rear sprocket. The result is the "gear number" in inches. The trade has dropped the dimensional unit of inches and the gear is known as a number. This calculation may be expressed by the following formula:

$$G = \frac{FW}{R}$$

where G = bicycle gear number;
F = number of teeth in front sprocket;
W = rear wheel diameter, in inches; and
R = number of teeth in rear sprocket.

In this new three-speed drive, the gears are reduced 25 per cent and increased 33 1/3 per cent from normal gear, so that the three gears may be computed as follows:

$$\text{Low } G = \frac{FW}{R}$$

$$\text{Normal } G = \frac{4FW}{3R}$$

$$\text{High } G = \frac{16FW}{9R}$$

In a "Triplspeed" equipped bicycle having 26- by 2 1/8-inch balloon tires, a 26-tooth front sprocket, and a 13-tooth rear sprocket, low gear would be 53, normal gear 70, and high gear 94.

Therefore, with the new three-speed coaster brake, a bicycle travels about 14 feet in low gear for each revolution of the pedal, about 18 feet in normal gear, and about 24 feet in high gear.

* * *

Television is using larger quantities of rolled nickel, with indications that the amount will continue to increase. Pure nickel is being used for the cathodes of the camera and picture tubes of television equipment due to its ability to retain its strength and stiffness at high temperatures (1650 degrees F.) and also because it serves as a good base for the oxide coating that gives off the electrons.

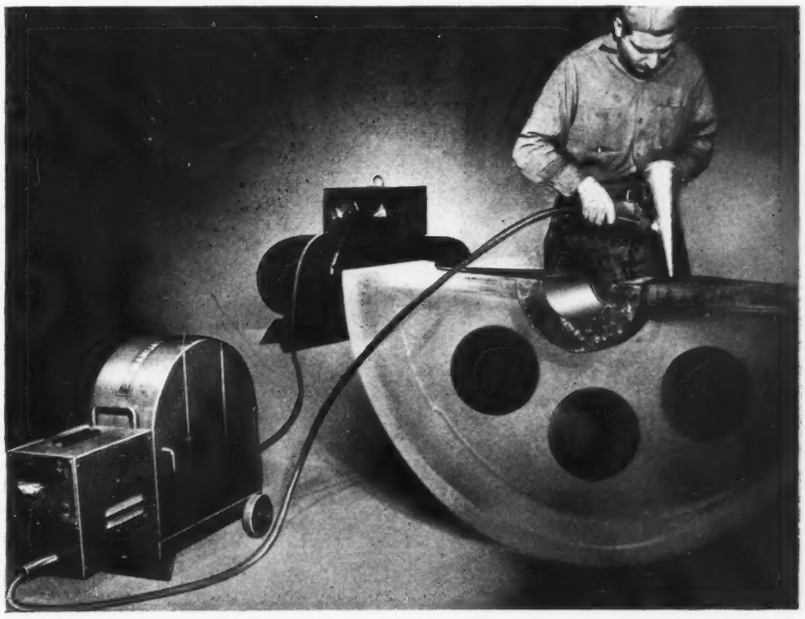
Hidden-Arc Welding Process that Employs High Current Densities

A new welding process employing current densities on 5/64-inch electrode wire that melt the electrode at speeds comparable to those obtained in using 10,000 amperes on a standard 5/16-inch diameter coated hand electrode has been developed by the Lincoln Electric Co., Cleveland, Ohio. This new "Hidensity" process can be used with any standard Lincoln Electric S A E 600 or 900 welding generator or with an S A E 600 gasoline-engine driven generator.

Either a 3/32- or a 5/64-inch diameter electrode wire is used. Welding currents up to 600 amperes used with these small cross-sectional area electrode wires produce extremely high current densities that create a deeply penetrating arc which, in turn, permits the use of high welding speeds. Comparatively little or no edge preparation of joints is required, and a minimum of weld metal produces completely fused joints.

In using the "Hidensity" process, a manual Lincolnweld ML-2 unit is connected to a welding generator. This arrangement provides all the features of an automatic welding head. The unit can be moved to the work independently of the generator.

The mechanism automatically feeds wire at a pre-set arc voltage and variable speed from the reel. The wire passes through the conductor cable and the welding gun to the work. The gun holds inorganic granular flux, which is deposited around the high-density arc, completely covering the arc and crater as the gun is moved over the joint being welded. The welding gun is moved either by hand or by a mechanized carriage of the cutting torch type.



Application of new hidden-arc welding process. Unit seen at the lower left, which is connected to a standard welding generator, contains controls, wire reel, conductor cable, and welding gun for welding at high current densities

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Jig Designed for Rapid Drilling of Air-Valve Part

By ROBERT W. NEWTON
Assistant Chief Tool Designer
New York Air Brake Co., Watertown, N. Y.

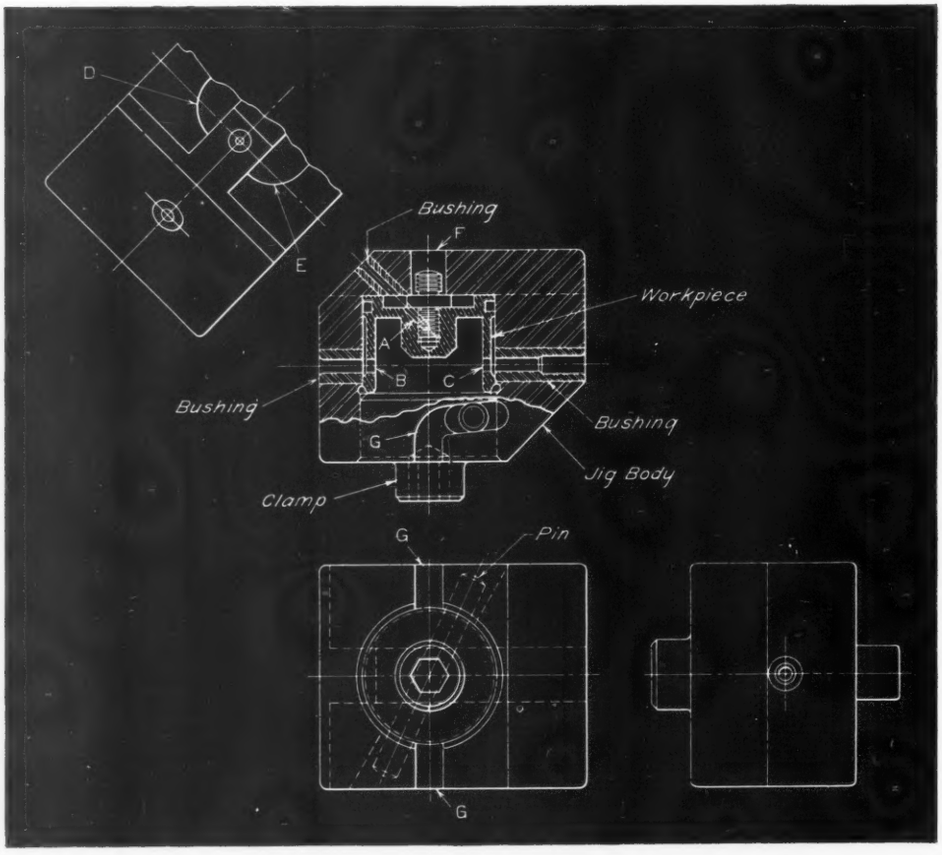
The drill jig shown in the accompanying illustration is a good example of the simplicity of design that can be attained by using the so-called "bayonet lock" type of clamp. A clamp of this type also keeps the loading time down to the minimum required for economical production.

The jig is composed of only six pieces—the body, clamp, pin, and three bushings. The side of the body opposite the drill bushing for the angular hole in the work-piece is machined at an angle of 90 degrees to the axis of the bushing hole to serve as a base while drilling the hole. This arrangement eliminates the necessity for providing a separate angle-block.

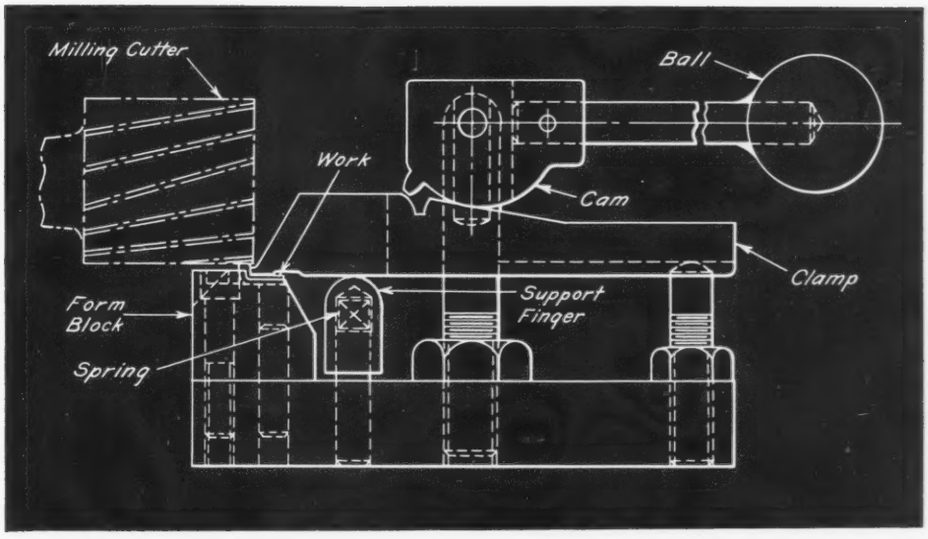
The jig is designed for drilling the angular hole at *A* and the two holes *B* and *C* at opposite sides of the work. The work-piece comprises a sub-assembly of a high-pressure valve and stud for a sensitive air control valve. This valve is part of a modern air brake used on the latest type of Diesel locomotive.

The body of the jig is bored to a slip fit for the work-piece. The opposite end of the jig is flatted on both sides of the center to meet the bottom of this bore. This provides openings at *D* and *E* for the escape of chips. A clearance hole *F* is also drilled through this end to clear the stud in the work-piece.

The three drill bushings are pressed into holes that are accurately positioned in the jig body. The clamp is a slip fit for the hole in the body,



Jig with quick-acting bayonet clamp for drilling holes in three sides of a sensitive air-valve part. Design is simplified and loading time kept to a minimum by the use of this type clamp



A tooth on the under side of the cam enters a notch in the top of the clamp to move the clamp to the right or the left when the ball handle is raised or lowered

which is made larger than the locating bore for the work, so that the jig will be easier to load. The top of the hole in the body and the end of the clamp are chamfered to facilitate inserting the clamp.

Bayonet slots *G* on the sides of the body are made a slip fit for the pin pressed into the clamp. These slots have a radius bend and a lateral section which permit the pin to be given a clockwise turn. These lateral ends of the slots are machined at an angle of about 95 degrees to form cam surfaces which give the bayonet lock its clamping action against the work-piece. The lateral slot on one side extends in the opposite direction from the one on the other side. The work should be clamped when the pin is at about the middle of the lateral part of the slots.

The length and diameter of the hub on the end of the clamp are such that the hub clears the plane of the flat on the side of the body on which the jig rests when drilling the angular hole. This flat provides sufficient surface beyond the center line of the bushings to permit drilling one side hole and the angular hole without causing the jig to tip. Because it is necessary to have a small hub at the end of the clamp, a hexagon socket is machined in it to fit an Allen wrench, so that the clamp can be easily tightened or loosened.

Milling Fixture with Cam-Actuated Clamping Device

By CLIFF BOSSMANN, Tool Designing Department
National Cash Register Co., Dayton, Ohio

Work can be clamped with one quick stroke in the milling fixture shown in the accompanying illustration by a cam-actuated clamping device. The work-piece is shown secured between the clamp and the form block, ready for the milling operation. It will be noted that the cam is provided with a handle having a ball on one end. At the completion of the cut, the handle is raised to a vertical position. This causes a tooth on the under side of the cam to enter a notch in the top of the clamp, thus moving the clamp away from the form block and permitting the part to be unloaded.

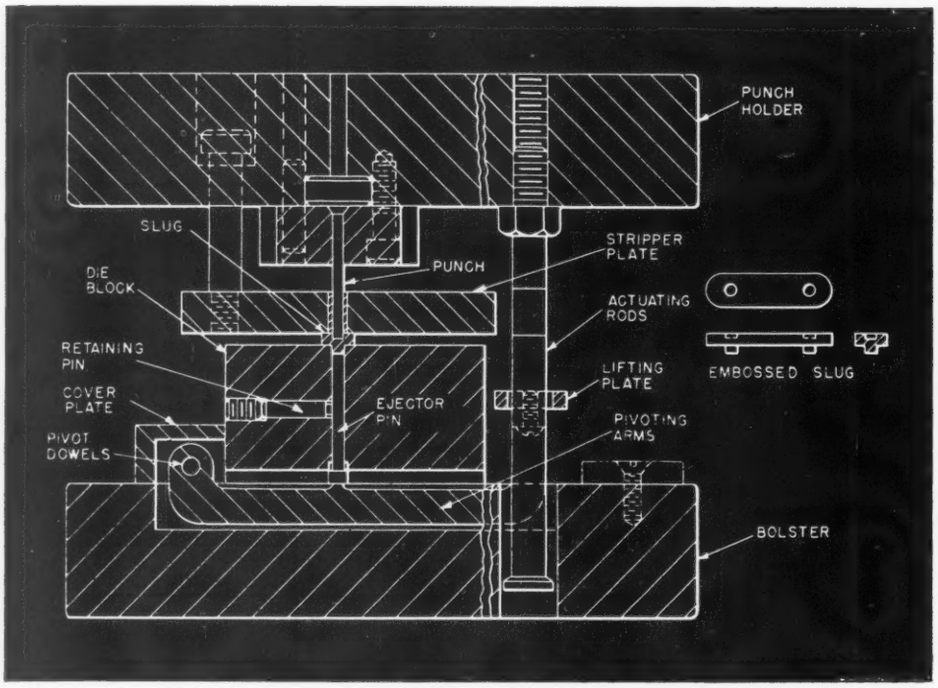
The clamp is held in contact with the cam by a spring-loaded support finger which slides up and down on a dowel-pin. When another part has been placed on the form block, the ball is again lowered to the position shown. The tooth provides a positive engagement between cam and clamp, moving the clamp to the left over the part. The cam surfaces then force the clamp down on the part, holding it securely during the milling operation. The weight of the ball prevents the part from working loose due to chatter or vibration.

Positive Ejector for Removing Embossed Part from Die

By F. A. ADAMS, Dayton, Ohio

Frequently the occasion arises when positive ejection must be effected after accurate projections have been formed on a part in a die. A positive method for ejecting an embossed slug from a die is shown in the accompanying illustration (see following page).

As the press ram descends, the stripper plate holds the slug tightly against the die-block until the two punches enter the work sufficiently to form the two projections on the under side. When the ram rises, actuating rods, which are



Positive method of ejecting an embossed slug from a die. When the press ram rises, actuating rods cause two arms to pivot and lift the ejector-pins, thus pushing the part from the die

screwed into the punch-holder, are carried upward. Flanges on the lower ends of the rods contact the under side of a lifting plate that is screwed to two pivoting arms. As the ram continues to rise, these arms pivot about dowels pressed into a cover plate, thus lifting the ejector-pins and pushing the embossed slug from the die.

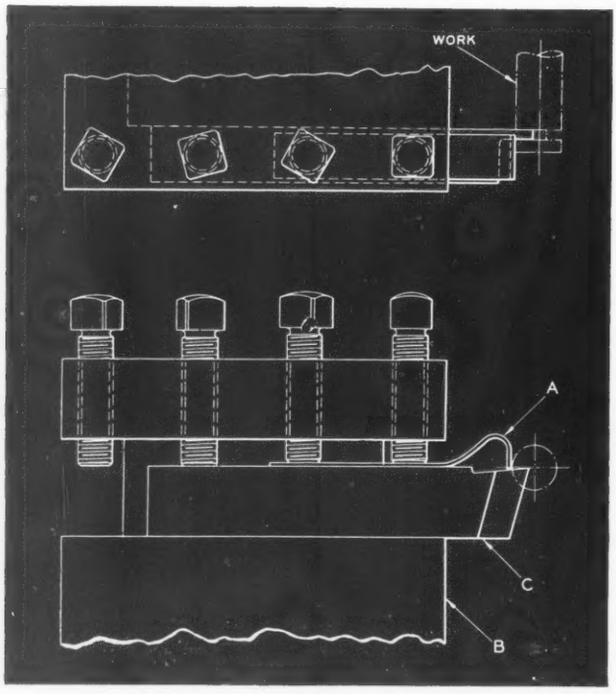
The cover plate, which is screwed to the bolster, also serves to keep dirt from interfering with the action of the pivoting arms and ejector-pin. When the die-block requires sharpening, the ejector-pins are raised until their tops are flush with the upper surface of the die-block. The pins are locked in this position during grinding by retaining pins backed up with set-screws.

Spring Used with Cut-Off Tool on Turret Lathe to Eject Work

By ROGER ISETTS, Kenosha, Wis.

When small pieces of stock are being cut off on a turret lathe or screw machine, the finished parts are likely to become lost or be hard to locate if some method is not provided to keep them from getting mixed up with the chips at the bottom of the machine.

The method illustrated, though simple and inexpensive, works surprisingly well. A small flat piece of spring steel *A* is bent into a loop at one end and placed under the cutting tool hold-down screws in the square cross-slide turret *B*. It is positioned so that when the cut-off tool *C* is fed into the work, there is spring tension against the section of stock that is being cut off. Thus when the tool has passed through the stock, the finished part is thrown out of the way by the spring, and can be caught in a box or pan placed at the back of the machine.



Method of utilizing spring pressure to facilitate ejection of small work from turret lathes or screw machines at the completion of the cutting-off operation

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER
Lester, Hankins & Silver
Sales Management Engineers
New York and Philadelphia

Letters to Prospects Can Help Sell

"There's one of Joe Murphy's long-winded letters," exclaimed a prospect as I walked into his office. "I'll read it when I get time." With that, he tucked the letter into a stack of miscellaneous papers to look at later.

"Do you read all your mail?" I asked. "My, no!" he replied. "If I did, I wouldn't get any work done."

This is typical of what happens to many letters which some of us write. The reason is that we write the kind of letter we like to write rather than the kind the prospect likes to read. We write letters as a chore, with minimum care.

How Can Letters Help Sell?

Letters can convey useful ideas to supplement face-to-face selling, but they must be timed and fashioned to suit the reader. They can briefly confirm and strengthen verbal information or register more firmly our commitments and those of the prospect.

They can instigate or extend the prospect's recognition of a need.

They can inform the prospect of our product and services.

They can build up interest and preserve personal contact with the prospect.

They can make a direct inquiry or help correct a wrong impression.

Letters that don't have such purposes as these can destroy good will rather than create it. In short, every letter written must add force to the process of selling.

So often letters lack crispness. They are almost invariably too long. Looking over ten typical letters written by salesmen, I found that from 20 to 40 per cent of the words could be cut out, thereby increasing effectiveness.

Ideas are often poorly arranged. Each one fails to be "buttoned up" as we proceed—too much backing and filling.

They lack personality—are written as though they come from a "company" rather than an individual. Just read over some letters you have written, and imagine yourself talking that way!

In reply to an inquiry, many a letter fails to cover a pertinent point of interest to the prospect.

Many sales engineers' letters appear drab; they don't spell interest, willingness to serve, or appreciation.

How Can We Improve Our Letters?

First, make sure we have something worthwhile to say.

Second, note mentally or on a scratch pad the ideas we intend to convey. Arrange these ideas in logical sequence.

Third, use our own way of expressing these ideas, but always within the scope of brevity. "Shirt-sleeve" English appeals. The slang of yesterday is common phraseology today.

Fourth, introduce the personal touch, shaping it with a mental image of the man we are writing to and his interests.

Fifth, express each idea clearly, and separate different ideas into short paragraphs, easily read. Avoid the reader's question: "Well, what's this fellow trying to say?"

Sixth, in enclosing a printed circular, focus attention upon its important points.

Seventh, limit a letter to one page. If this can't be done, use a separate memorandum containing facts logically and briefly set down. Attach this memo to your letter, which should bear the earmarks of a personal message.

Eighth, cut down on the "I's" and emphasize the "you's."

There is no denying that some corporations have rules requiring that letters be addressed only to a department or division. Even with this obstacle, we can create a favorable impression by making our letters brief, logical, factual, and complete. Since we usually know into whose hands the letter will fall, we can frame its contents to the reader's particular interests.

Remember the dynamic power of Lincoln's Gettysburg Address. It was a masterful job in selling ideas as real today as almost a century ago.

"Writing a letter!" we may say, "Why, that's something ordinary — something most anyone can do." But do we realize that the letter when received by the prospect stands alone? It represents you and your company. It can help make or help ruin the prospective machinery order.

* * *

Gaging Star-Shaped Punch and Die

By HENRY R. BOWMAN

I recently had occasion to design a star-shaped box and cover made of thin sheet metal. The cover flange had to be an extremely accurate fit on the box and yet be easily removable. It also had to have the same fit in each of five positions.

First, the punch was made slightly over size and the die slightly under size. Then they were ground to exact size, using precision button gages for checking. By gaging across the two larger buttons in the external position shown in the diagram and also in the two other similar positions, the accuracy of the punch was checked. Likewise, by gaging across the two smaller buttons in the internal position shown and in the two other similar positions, the accuracy of the die was checked.

The following formulas establish the center distance X between the two larger buttons and the center distance Y between the two smaller buttons.

$$A = R \sin 36 \text{ degrees} = 0.58778R \quad (1)$$
$$B = R \cos 36 \text{ degrees} = 0.80902R \quad (2)$$
$$C = A \tan 36 \text{ degrees} = 0.72654A \quad (3a)$$
$$C = 0.72654 \times 0.58778R = 0.42705R \quad (3b)$$
$$D = B - C = 0.80902R - 0.42705R \quad (4a)$$
$$D = 0.38197R \quad (4b)$$
$$E = L \sec 36 \text{ degrees} = 1.2361L \quad (5)$$
$$F = (D + E) \cos 18 \text{ degrees} = 0.95106\ (D + E) \quad (6a)$$
$$F = 0.95106\ (0.38197R + 1.2361L) \quad (6b)$$
$$F = 0.36328R + 1.1756L \quad (6c)$$
$$X = 2F = 0.72656R + 2.3512L \quad (7)$$
$$G = S \operatorname{cosec} 18 \text{ degrees} = 3.2361S \quad (8)$$
$$H = (R - G) \cos 18 \text{ degrees} = 0.95106\ (R - 3.2361S) \quad (9a)$$
$$H = 0.95106R - 3.0777S \quad (9b)$$
$$Y = 2H = 1.90212R - 6.1554S \quad (10)$$

The gaging distance over the larger buttons would then be $X + 2L$, and over the smaller buttons $Y + 2S$.

Example—Find the gaging distances for the punch and die for a five-pointed star having a radius R of 2 inches. The radius S of the smaller gaging buttons is 0.125 inch, and the radius L of the larger gaging buttons is 0.3906 inch.

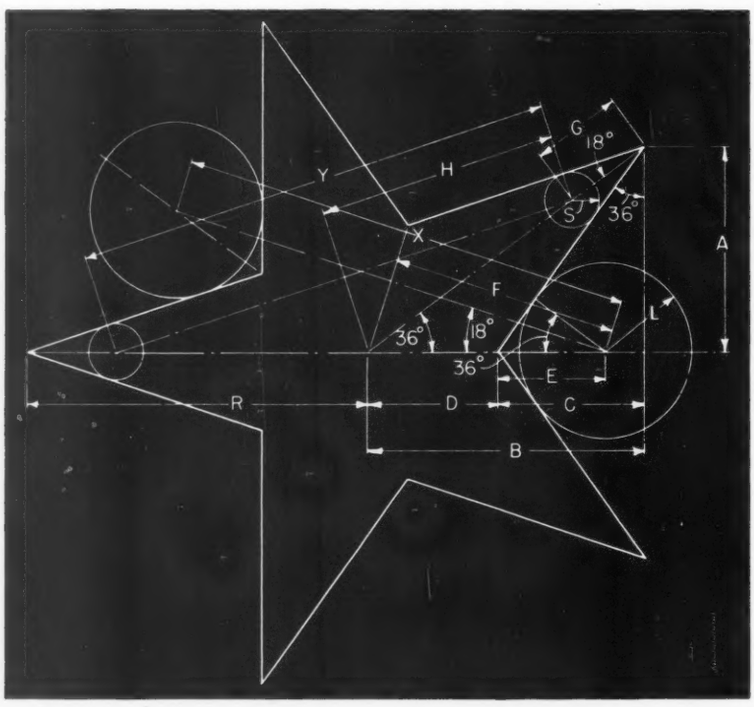
Solution:

$$X = 0.72656R + 2.3512L \quad (7)$$
$$X = 0.72656 \times 2 + 2.3512 \times 0.3906$$
$$X = 1.45312 + 0.91838$$
$$X = 2.3715 \text{ inches}$$
$$X + 2L = 2.3715 + 0.7812 = 3.1527$$

inches which is the gaging distance over the larger buttons when placed against the punch as shown.

$$Y = 1.90212R - 6.1554S \quad (10)$$
$$Y = 1.90212 \times 2 - 6.1554 \times 0.125$$
$$Y = 3.80424 - 0.76942 = 3.0348 \text{ inches}$$
$$Y + 2S = 3.0348 + 0.250 = 3.2848$$

inches which is the gaging distance over the smaller buttons when placed inside the die as shown.



Method of gaging star-shaped punch and die using two pairs of button gages. With (R) known, (X) and (Y) can be found

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

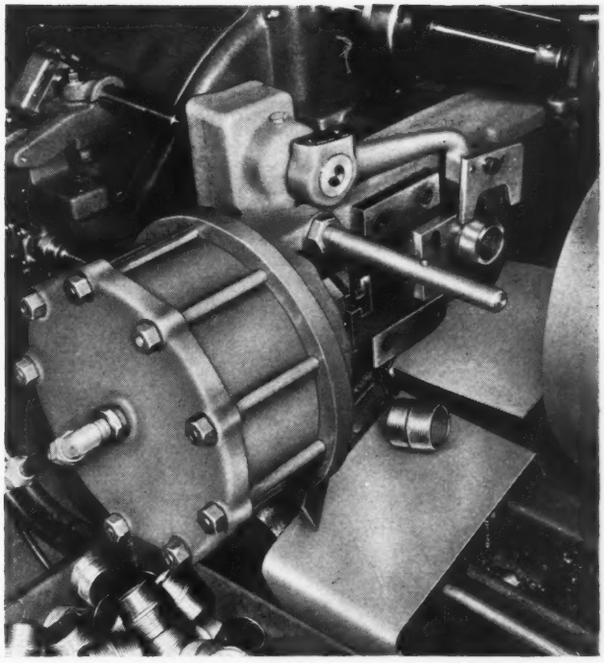


Fig. 2. Close-up view of transfer mechanism on machine illustrated in Fig. 1

Landmaco Automatic Pipe-Nipple Threading Machines

Landis Machine Co., Waynesboro, Pa., has brought out two new Landmaco No. 2 automatic nipple threading machines, one for threading regular length nipples and the other for threading close length nipples. These machines thread, ream, and chamfer pipe nipples in a continuous automatic operation, thus eliminating secondary manual handling. A mechanism which transfers and turns the nipple end for end permits these operations to be performed on both ends of the work in a continuous cycle.

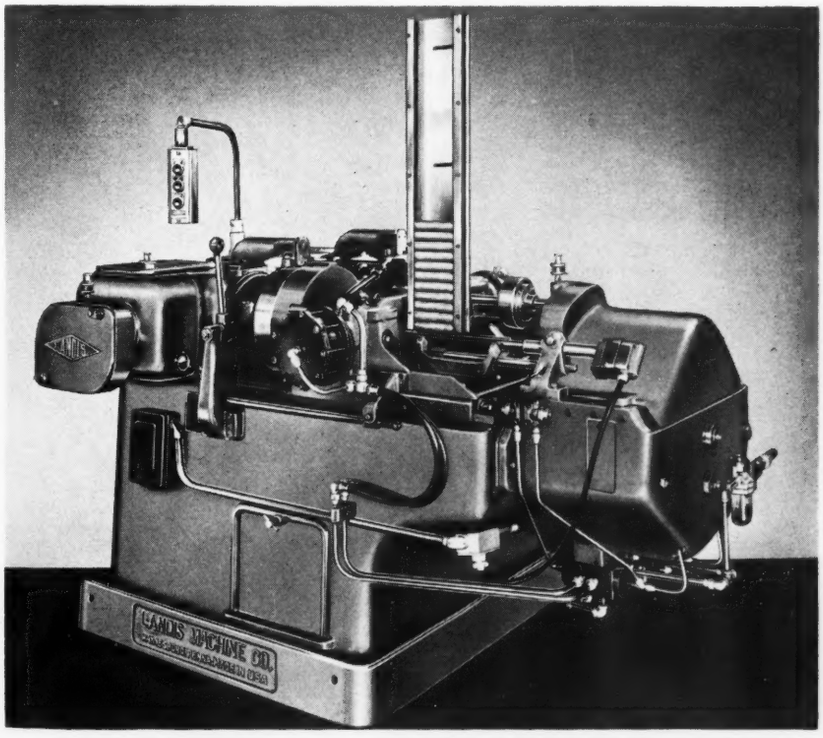


Fig. 1. "Landmaco" automatic pipe-nipple threading machine

The machine for regular length nipples is designed to produce commercial standard long nipples up to 6 inches in length. This machine is built in two size range capacities—a 1/2- and 3/4-inch range and a 1- to 2-inch range.

The automatic close nipple threading machine produces commercial standard close, short, and special short nipples when equipped with the new close nipple attachment. This machine also is built in two range capacities.

The operator is required to give either machine only visual attention and to keep the magazine on the carriage, (see Fig. 1), charged with nipple blanks. One operator can supervise two machines when producing 1/2- and 3/4-inch nipples, and a battery of three machines when producing 1- to 2-inch nipples. Regardless of the type of nipple, production rates range from 193 to 625 an hour, depending upon the pipe size.

After being released automatically from the magazine by the backward movement of the carriage, the nipple blank is pushed into position in the grips, following which the air-operated vise closes to hold the blank in position for the initial threading, chamfering, and reaming opera-

To obtain additional information on equipment described here, use Inquiry Card on page 217.

tions. The left-hand carriage advances rapidly to the threading position and then assumes a feed rate of travel equal to the lead of the thread being cut. An accurately machined cam controls the entire carriage movement.

After the threads have been cut and the chamfering and reaming operations completed simultaneously on one end of the nipple blank, the die-head and vise open automatically and the carriage returns to the loading position. The semi-finished nipple is left in position on the work-rest bar for transfer to the right-hand carriage.

A transfer mechanism having mechanical fingers, Fig. 2, removes the semi-finished nipple, turns it end for end, and places it in position on the work-rest bar of the right-hand carriage. The semi-finished nipple is then pushed into position and gripped for the threading, reaming, and chamfering operations on the unfinished end.

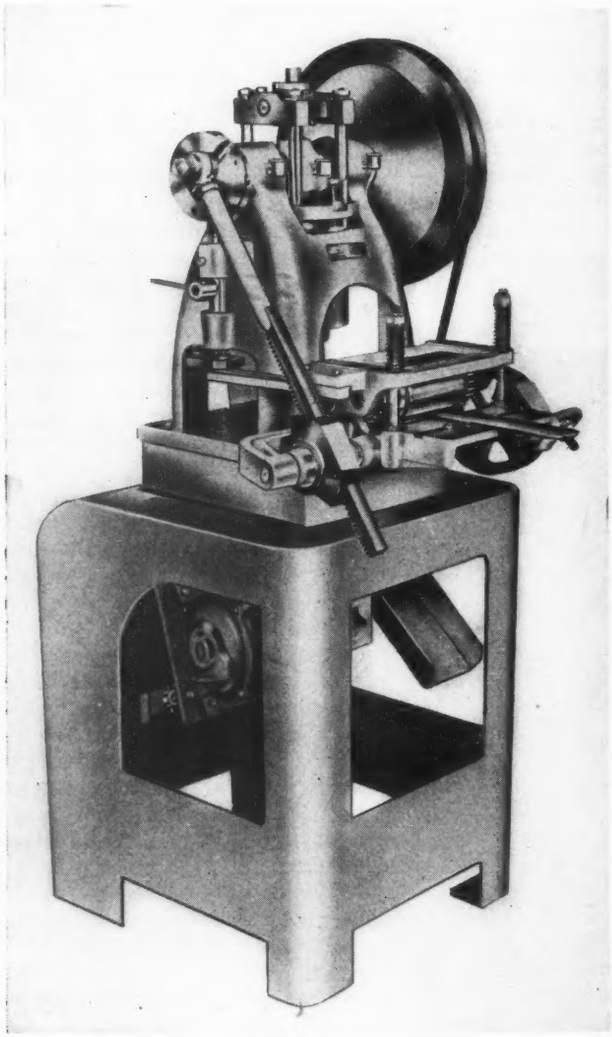
While these operations are being performed by the right-hand carriage, a second blank is being machined by the left-hand carriage. After completion of the final operations, the nipple is ejected automatically from the machine. 55

Improved Diebel "Hi-Speed" Press

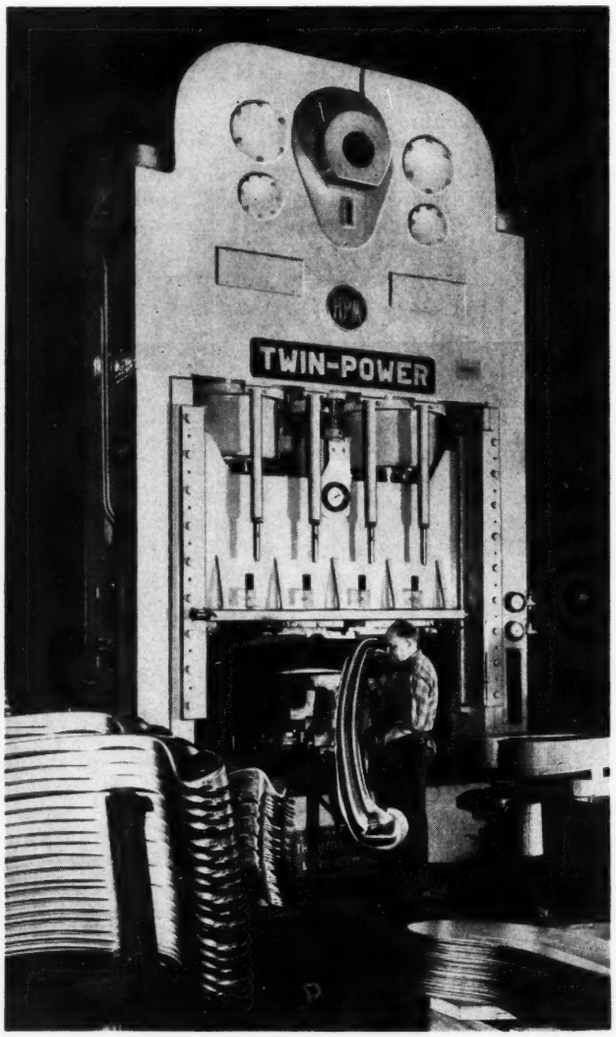
The Di Machine Corporation, Chicago, Ill., has completely redesigned its 5-ton "Hi-Speed" automatic press. The improved press has a new base that encloses the motor, belt, and pulley, and it is provided with a feed of more rigid construction. It also has a heavier gear rack and a simpler adjustment plate for more positive operation with less adjustment. Other features of the improved design include a top roller lifting mechanism and a positive knock-out for compound dies. 56

"Twin-Power" Metal Drawing Press

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has brought out a new mechanical metal drawing press called the "Twin-Power," which is said to make possible increases in production as great as 50 per cent. Instead of having an eccentric or crank stroke equal to the press stroke, as in the case of mechanical presses of conventional design, the new press has an eccentric stroke that is less than half the press stroke. This short eccentric stroke is applied only to the lower



Improved design of 5-ton high-speed press built by the Di Machine Corporation



"Twin-Power" metal drawing press brought out by the Hydraulic Press Mfg. Co.

To obtain additional information on equipment described here, use Inquiry Card on page 217.

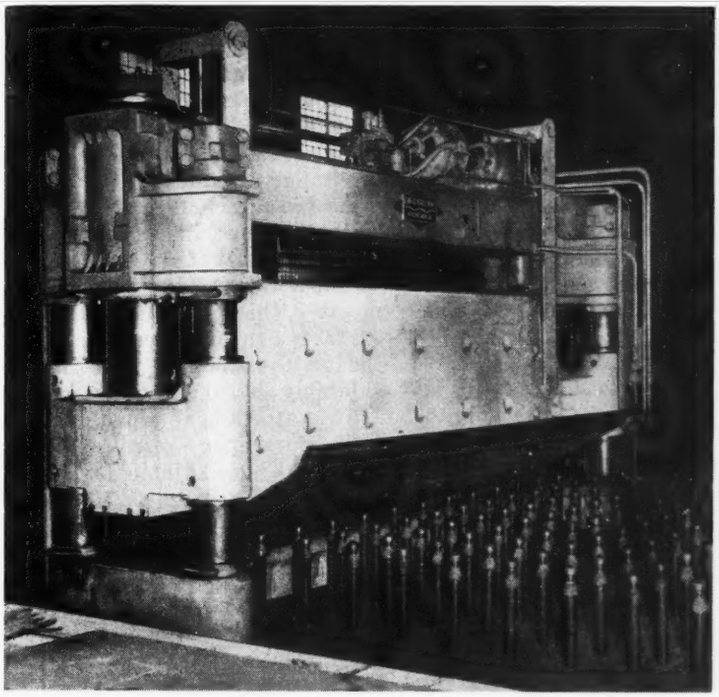


Fig. 1. Birdsboro hydraulic bending press for crimping the edge of a large metal sheet in one stroke

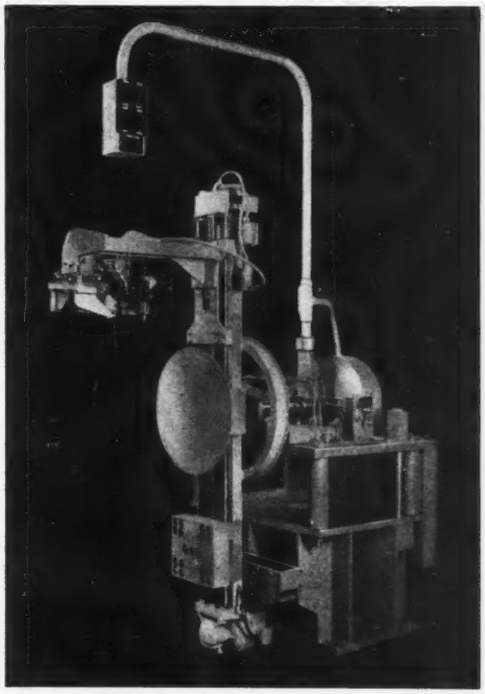


Fig. 2. Birdsboro flame-cutting, trimming, and beveling machine

or working part of the press stroke. The approach part of the press stroke is effected independently of the eccentric by means of fluid action.

The application of the short-stroke eccentic results in an increase in strokes per minute up to 70 per cent when conventional drawing speeds are used, or, conversely, it decreases the drawing speed as much as 45 per cent if the customary number of strokes per minute are desired. The short-stroke eccentric also provides higher tonnage through the greater portion of the working stroke, making it possible to perform many jobs on a press having a lower tonnage rating. 57

Hallowell Hand Truck with New Nose Construction

The Standard Pressed Steel Co., Jenkintown, Pa., announces a new Hallowell "Uni-Truk" with triple-welded angle construction of the nose, which eliminates danger of the ends of the side bars tearing loose. The frame is welded steel channel with a single handle. The cross-members are curved steel channel, and the nose is heavy pressed steel, ribbed for strength, and made to an angular shape to permit a stronger weld to the frame. 58

Birdsboro Improved Pipe-Forming Machines

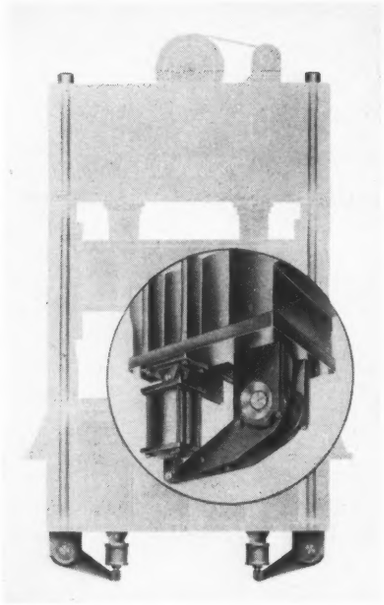
The Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., recently built three machines designed to simplify the bending, flaring, and beveling operations required in producing pipe from metal sheets or plates. One of these machines—the 1200-ton hydraulic bending press shown in Fig. 1—crimps the entire edge of a sheet 24 feet 4 inches long in one stroke. The sheet is first moved into the machine over the die, which crimps one edge. The sheet is then retracted and rotated. Next, the other edge of the sheet is moved over the die and crimped. This method of pressing an entire side of the sheet at once is said to be faster than the usual progressive method of crimping, in which the plate is fed continuously through a crimping roll. The new method also provides a more uniform bend, which facilitates handling the work when welding operations are being performed on the pipe seam.

This bending machine is 27 feet long, has a 36-inch adjustable stroke, is driven by a 60-H.P. motor, and is equipped with a self-contained pumping unit. It is used in producing pipe from 16 to 36 inches in diameter. Geared to the speed of the welding equipment, its present production is about eight pieces per hour, but it could be readily speeded up to triple its production should occasion demand.

Another machine built to operate in the same pipe forming line is a 300-ton hydraulic flaring machine (not illustrated) which will handle pipe of the same diameter as that accommodated by the bending press just described. This machine is adapted for any pipe within its capacity range by simply changing dies. After being flared on this machine, the pipe is expanded hydraulically by applying pressures varying from 2300 to 3000 pounds per square inch, depending on the diameter and wall thickness of the pipe.

The third new pipe machine is the beveling machine shown in Fig. 2. This is unique in that it performs two operations at once. It flame-cuts and trims the edges of the pipe and bevels them simultaneously. Two of these machines are used in the production line, so that both ends of the pipe are beveled simultaneously. This machine is also built to handle pipe ranging from 16 to 36 inches in diameter.

These new pipe-forming machines are being installed in the pipe department of a large steel company in the East. 59



Clearing mechanical press equipped with overload safety device

Overload Safety Device for Mechanical Presses

An overload safety device for large mechanical presses, which provides several advantages in addition to the safety feature, has been announced by the Clearing Machine Corporation, Chicago, Ill. When so specified, Clearing presses now being manufactured will include this "Loadtrol" device.

This unit is applied to one end, usually the bottom one, of each tie-rod. It consists of an air cylinder connected to a lever arm through an eccentric pin arrangement in such a way that the tie-rod moves a short distance when a predetermined pressure is exceeded. This movement results in disengaging the clutch through an electrical control.

In addition to providing protection against overload damage, this safety device makes it possible to preload the tie-rods cold in only a few minutes. Since the yielding pressure can be adjusted as required, die try-out and setting operations are greatly simplified. When small dies are used that require less than full press capacity, the "Loadtrol" can be set accordingly to prevent damage to the dies. A modification of the same device is also available for protecting the links on the outer slide of a double-action press. 60

Gisholt Heavy-Duty Superfinishing Attachment

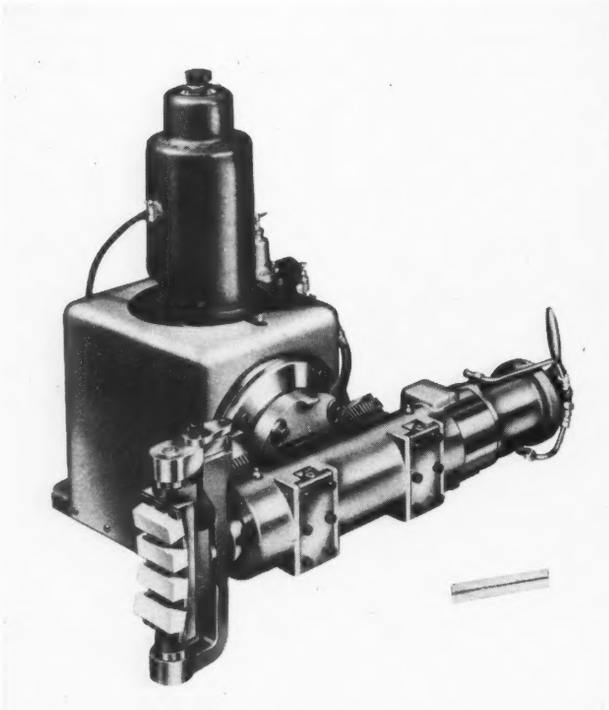
The largest in a line of five sizes of superfinishing attachments has just been announced by the Gisholt Machine Co., Madison, Wis. This heavy-duty attachment, designated No. 4, can be used for either cylindrical or flat work wherever large areas are to be superfinished. It is designed to be mounted on an engine lathe or similar machine.

As the attachment is traversed along the work, the superfinishing stones contact the surface and "scrub" away the amorphous metal. Either ground or machined surfaces can be superfinished, although the working time is considerably less for ground surfaces.

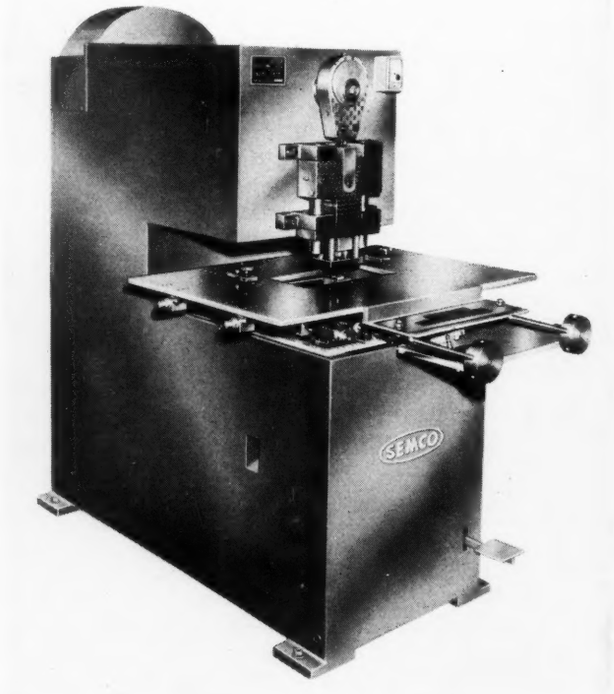
This attachment provides up to 1000 pounds per square inch pressure with an adjustable oscillation rate of from 42 to 250 strokes per minute. One to four stones up to 1 by 1 inch by 6 inches can be mounted in the quick-change holder. The complete unit is designed for operation on 220-volt, single-phase, 60-cycle, alternating or direct current. 61

Improved Nibbler Press

The operating speed of the new improved "Semco" nibbler press developed by Service Machine Co., Elizabeth, N. J., has been increased from 210 to 260 strokes per minute. Any shape of hole, slot, or notch up to 4 1/2 by 12 inches can be punched in sheets,



Heavy-duty superfinishing attachment brought out by Gisholt Machine Co.



Improved nibbler press placed on the market by the Service Machine Co.

To obtain additional information on equipment described here, use Inquiry Card on page 217.

strips, or plates up to 1/8 inch thick at a single setting. Duplications of punched holes, slots, or notches is positive, because punching is controlled by templets made of any sheet metal stiff enough to confine the follower-pin.

The improved nibbler press weighs 2100 pounds, occupies 28 by 55 inches floor space, exclusive of operating unit extensions, and is 69 1/2 inches high. The throat depth is 20 inches with 4 3/4 inches clearance and the stroke is 1 1/2 inches. Maximum shut height is 3 3/4 inches, and the minimum is 2 3/4 inches. Power is provided by a 1-H.P. motor, which drives through a high-reduction 73-pound flywheel. 62

Cross "Transfer-matic" Equipped for Machining Automatic Transmissions

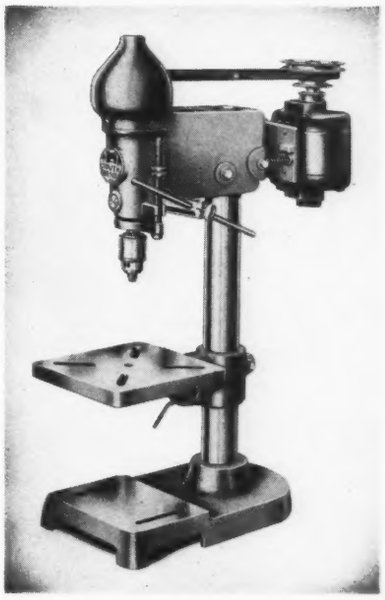
The Cross Company, Detroit, Mich., has recently added a machine for drilling, boring, and tapping automatic transmission extensions to its line of special production equipment. The new "Transfer-matic" machine, equipped with automatic transfer mechanisms, has twelve stations, including one for loading, ten for cutting, and one for unloading. Two-position progressive, pallet type work-holding fixtures are used. These carriers are automatically returned from the unloading to the loading station on an integral conveyor.

The machine is equipped with "Toolometers," designed to control tool life and automatically stop the machine when tools need resharpening. Other features include hydraulic feed, rapid traverse, and the use of standard Cross sub-assemblies to facilitate maintenance, reduce "down" time, and provide flexibility for part design changes. 63

"Economy" Model South Bend Drill Press

The South Bend Lathe Works, South Bend, Ind., has announced a new "Economy" model 14-inch drill press. This machine is constructed for continuous industrial service, and is made in both bench and floor types. The weight of the bench type machine without the motor and chuck is 124 pounds.

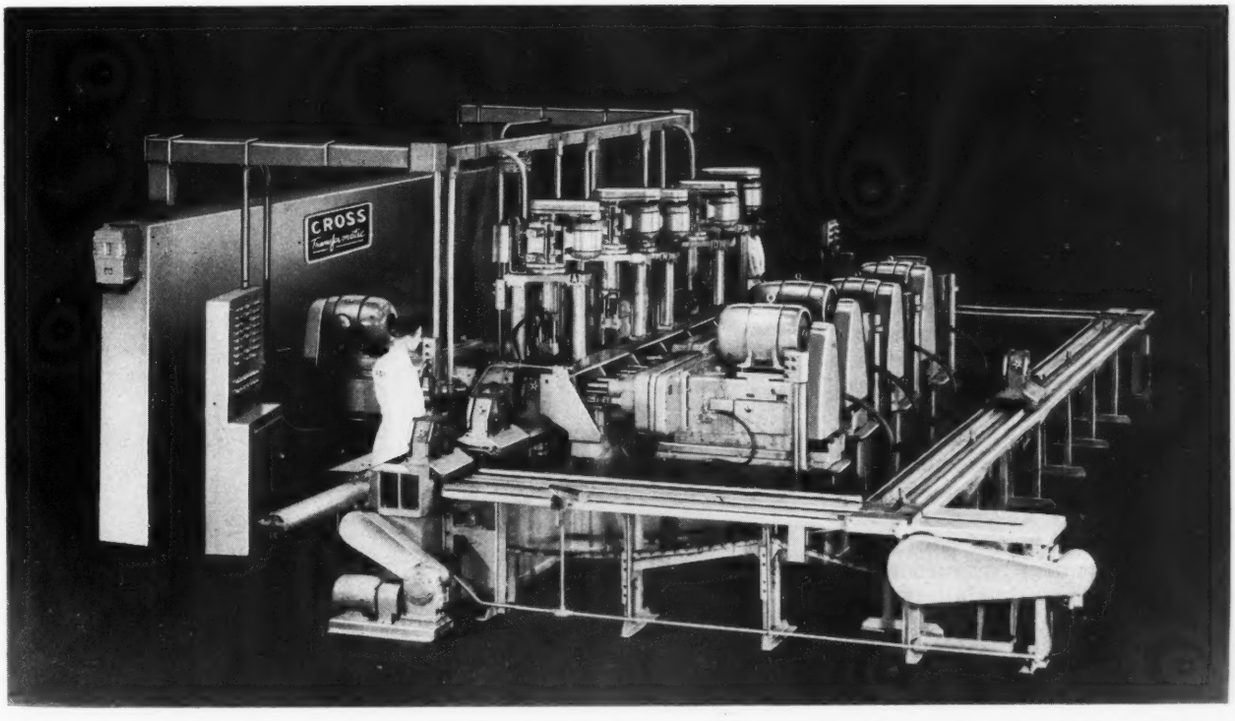
The new drill press has an automatic device that maintains proper tension on the motor belt and a spring arrangement that assists in absorbing shock if an obstruction is encountered in drilling.



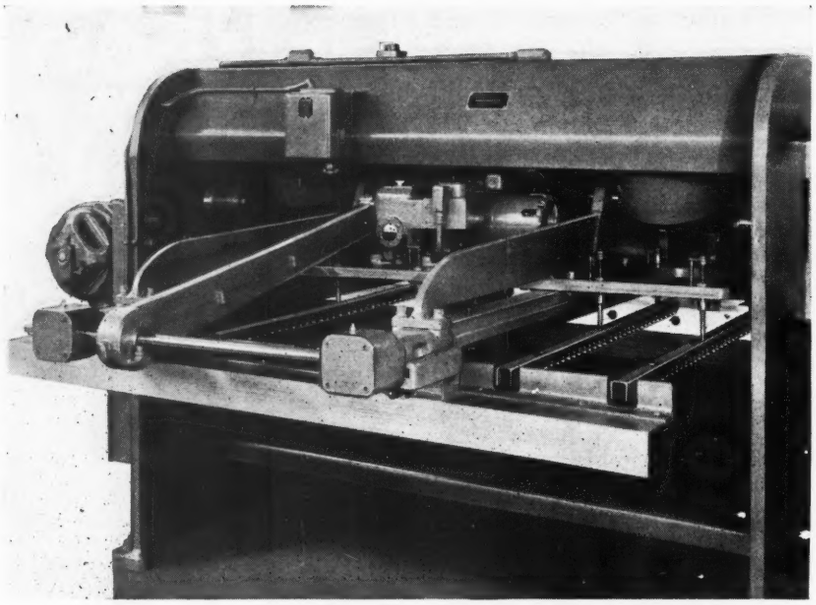
Bench type drill press announced by the South Bend Lathe Works

Other features include adjustable feed handle and one-piece head casting. The head and table column bearings have double-plug locking binders designed to maintain accurate alignment when either assembly is locked or unlocked on the column.

These machines have a capacity for drilling to the center of a 14 1/4-inch circle; maximum drilling capacity of 1/2 inch in steel;



"Transfer-matic" built by the Cross Company for machining automatic transmission extensions



"All Steel" shears equipped with "No-Sag" magnetic sheet support developed by Cincinnati Shaper Co.

Cincinnati Magnetic Sheet Support for Power Shears

The Cincinnati Shaper Co., Cincinnati, Ohio, has developed a "No-Sag" magnetic sheet support for its line of "All Steel" power shears designed to eliminate the difficulties experienced in gaging light-weight sheets that sag to such an extent that they do not strike the back gage. For example, a 20-gage sheet extending beyond the knife a distance of 20 inches will sag approximately 5 inches, making it impossible to gage the sheet accurately with the back-gage stop.

The magnetic sheet support is provided with permanent Alnico magnets, and has a unique roller arrangement, shown in the accompanying illustration, which facilitates handling the sheet when feeding the shear. There is no noticeable drag on the sheet due to the magnetic holding force, and the back pieces are automatically stripped off as the piece is cut. When cutting or shearing heavy plates that do not sag, the magnets can be raised to eliminate wear and possible damage.

The support is designed to handle all magnetic materials up to 16 gage, and can be supplied with either a 36- or a 48-inch

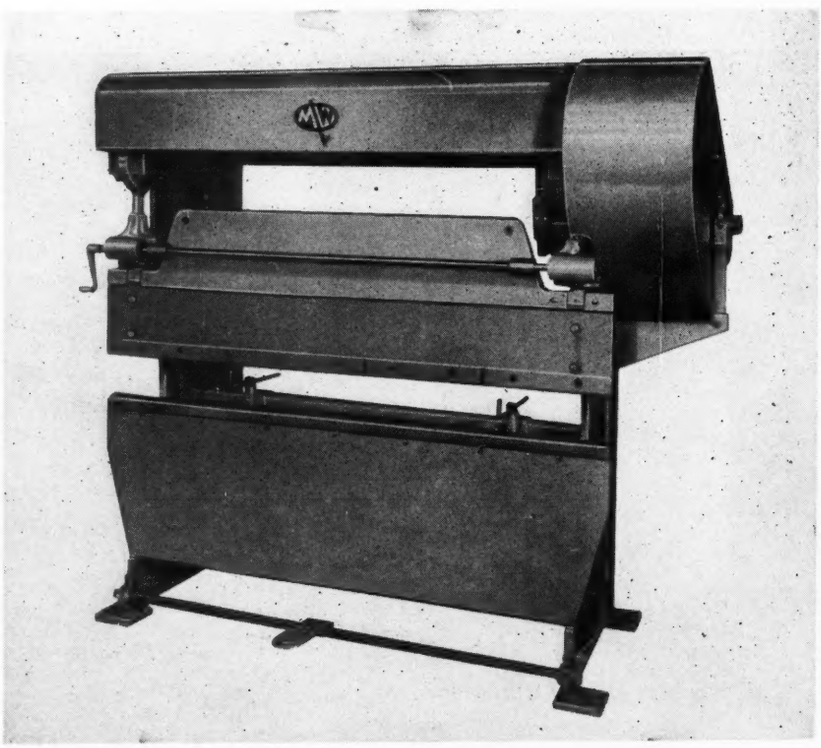
maximum spindle run-out of 0.005 inch; and a spindle that is square with table within 0.0075 inch in 5 inches. The table and base surfaces of the bench model are precision-ground and slotted. The table also has a 3/4-inch thick edge rib all around for clamping work.

Four spindle speeds ranging from 740 to 4070 R.P.M. are available through a 1/3- or 1/2-H.P. 1725-R.P.M. motor. Additional speeds from 380 to 7770 R.P.M. can be obtained by the use of a multi-speed attachment if the drill press is equipped with a capacitor type motor. 64

"Metal Worker" Press Brake

A completely new line of press brakes designed for bending, form blanking, or multiple punching operations, known by the trade name "Metal Worker," has been brought out by the Airtherm Mfg. Co., St. Louis, Mo. Small size press brakes like the one illustrated have numerous features, such as rugged all-steel welded frames designed to maintain stability and accuracy; rugged single-plate friction clutch integral with the flywheel, which requires no special tools for adjustment; and single-plate friction brake that assures easy and positive engagement.

Positive gibs provide means for obtaining take-up in all directions. Ram adjustment equalizes thrust loads through the use of alloy-steel screws having one right-hand and one left-hand thread. A single through shaft keeps the torsional shaft deflection at a minimum. The lubrication system is so designed that all points are easily accessible. 65



"Metal Worker" press brake placed on the market by the Airtherm Mfg. Co.

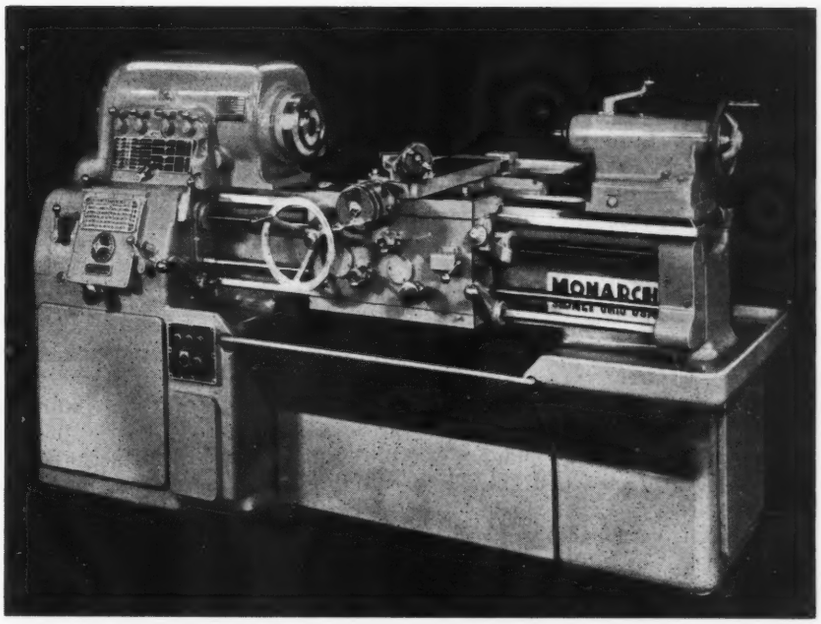
To obtain additional information on equipment described here, use Inquiry Card on page 217.

back gaging range. At present, this support is available as extra equipment only on new Cincinnati shears. ---------- 66

Small Size Lathe Added to Monarch Line

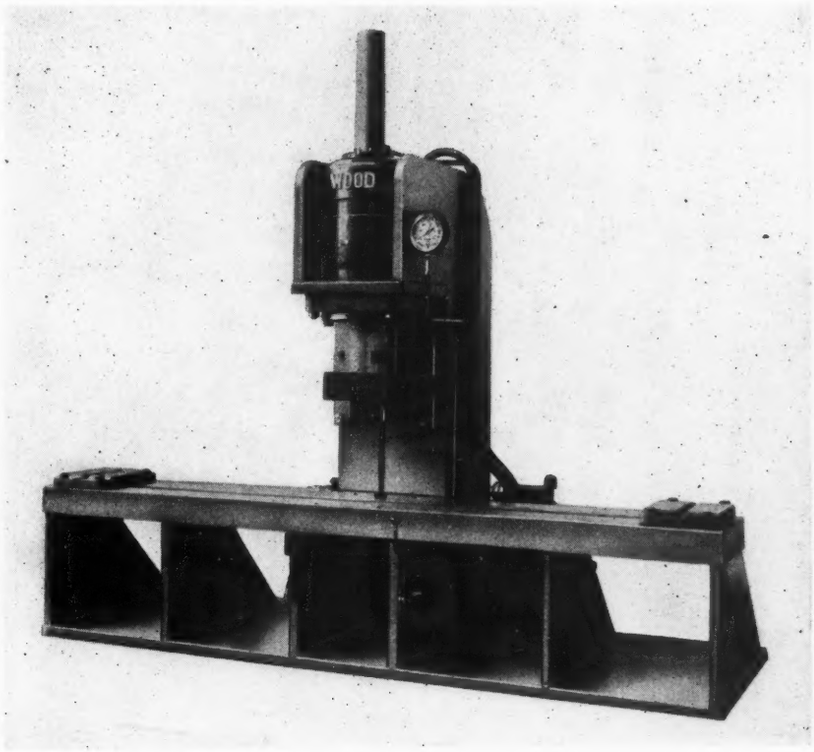
A 12-inch lathe, designed to handle smaller work than previous machines, has been added to the Series 60 line of the Monarch Machine Tool Co., Sidney, Ohio. The new machine is available in both engine and toolmaker's models, and incorporates the same basic design principles and operating features as the larger machines. Both the gear-box and gearing are totally enclosed, permitting automatic pressure lubrication of these mechanisms and preventing entry of foreign matter.

Helical gears made of hardened alloy steel with ground or shaved tooth contours are used in the headstock. The teeth of these gears are made extra wide, with a larger tooth contact area than ordinarily provided to assure more efficient transmission of power. Provision is made for rapid shifting from one speed to another. An American standard Type D-1 Camlock spindle nose is employed for accurate mounting and quick interchangeability of chucks, plates, and fixtures. The bed ways for both carriage and tailstock are flame-hardened and precision-ground.



Engine lathe recently added to line of larger machines built by Monarch Machine Tool Co.

In addition to the gear-box and end gearing, the headstock, apron, carriage bearing on the ways, and compound bottom slide on the carriage are lubricated by the automatic pressure method. All bearings in the machine are of the anti-friction type. On the toolmaker's models, the tailstock is of the quick clamping type with a tang slot in the spindle to facilitate the ejection of drill and reamer sockets. Another feature found in the toolmaker's models is the apron-controlled carriage reverse. ---------- 67



Vertical hydraulic straightening press built by the R. D. Wood Co.

Open-Gap Straightening Press

Straightening operations on tubes, shafts, bars, and similar pieces can be performed on a new 100-ton hydraulic press built by the R. D. Wood Co., Philadelphia, Pa. This press is 10 feet high and occupies a floor space of 50 by 148 inches. The main ram, which is 13 inches in diameter, has a 12-inch stroke.

The work-table is 22 1/4 by 148 inches, and there is a daylight space of 26 1/2 inches between the table surface and the ram-head face. The table is supplied with two bases mounted in machined grooves for assembling disks or anvil blocks. These bases can be easily moved any required distance either side of the center position, in increments of 6 inches. The ram head is grooved for the attachment of dies.

Hydraulic power is supplied by a two-pressure pumping unit and motor, mounted on a fabricated steel suction tank at the rear.---68

"Dupliform" Profile Dressing and Grinding Machine

The Airborne Accessories Corporation, Hillside, N. J., is introducing a new "Dupliform" machine designed to combine the features of a universal profile dresser and a profile grinder for the high-precision finishing of punches, dies, and machine parts that must have accurately formed profiles.

The dresser is pivotally mounted on the column of the machine, so that it can be swung out of the way when not in use. The diamond and tracer are mounted in the upper and lower ends, respectively, of a hardened spindle which is closely fitted in a hardened bearing surface in a precision adapter. Flexibility is provided by two intermediate pivot joints. The templet or sample is mounted in a holder on the table, adjacent to the chuck. Dressing is performed by guiding the tracer by hand over the templet.

The pivoted members are rigidly constructed to permit the diamond to reproduce faithfully the exact form required on the wheel. The three swivel joints of the dresser duplicate the action of the human arm, making the operation practically effortless.

The "Dupliform" process incorporates a simple means of correcting the tracer nose to correspond exactly to the diamond point. The unit holding the diamond and tracer is easily removed from the dresser proper and placed on the magnetic chuck, so that the wheel can be dressed to the exact form of the diamond. With the same set-up, the nose of the profile tracer is ground to conform to the exact shape of the diamond point. The unit is then replaced in the dresser, ready for the grinding process.

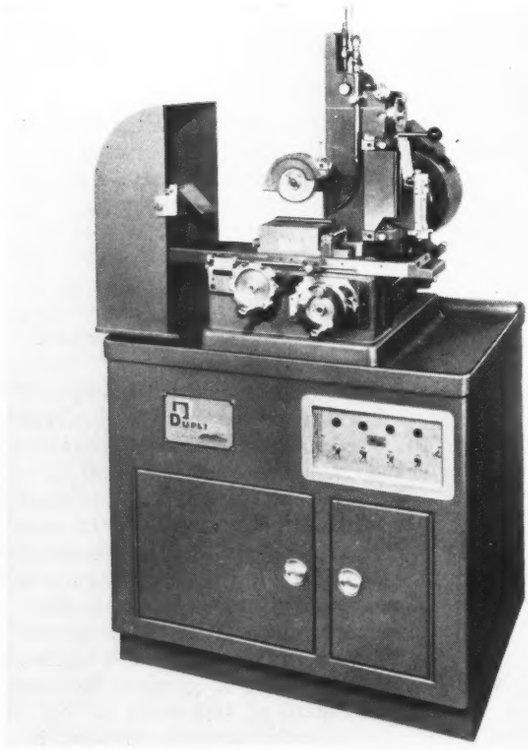
The basic steps in the finish-grinding of a typical punch and die consist of mounting the sample part in the templet-holder; dressing the wheel to the correct shape, using the sample part as a templet; profile-grinding the die, stripper, and punch-holder; dressing the wheel again, using the ground stripper as a templet; and finally, grinding the punch with the dressed wheel.

The machine table is 32 by 6 inches, and has a work surface of 5 by 12 inches, with a maximum height under wheel of 12 inches. It has a longitudinal travel of 14 inches, cross travel of 5 1/2 inches, and vertical travel of 10 1/2 inches. The grinding wheel is 5 inches in diameter by 1 1/4 inches thick, with a 7/8-inch hole. Maximum length of form produced on wheel is 4 inches, and the maximum depth 3 inches. The ratio of tracer to diamond motion is 1 to 1. The machine is 44 inches wide, 30 inches deep, and 65 inches high. 69

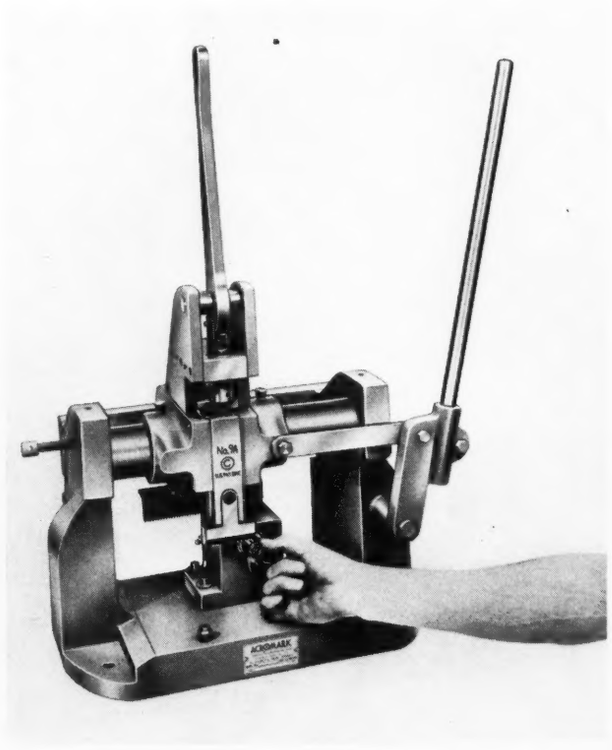
Fixture for Precision Marking

A fixture with special precision tooling has been brought out by the Acromark Co., Elizabeth, N. J., for the accurate marking of metal and plastic counter wheels, meter wheels, and similar parts. The die closing cam is designed to permit stamping immediately adjacent to starter pins or cams on the outside or periphery of the wheel blank.

The illustration shows the machine arranged for hand operation, but both air and electric power models are also available. Attachments for the hot-stamping of thermoplastic materials and most thermosetting materials can be furnished. Standard models take wheels up to 1 1/2 inches outside diameter, and specially constructed models extend the range to 3 1/2 inches. 70



"Dupliform" profile dressing and grinding machine made by Airborne Accessories Corporation



Precision marking fixture for plastic and metal parts brought out by the Acromark Co.

To obtain additional information on equipment described here, use Inquiry Card on page 217.

Visual thread comparator brought out by the Hanson-Whitney Co.

Hanson-Whitney Visual Thread Comparator

The Hanson-Whitney Co., Hartford, Conn., has placed on the market a new precision instrument expressly designed for inspection and production gaging of external threads. This instrument is adapted for checking all forms of threads, including critical aircraft threads. The indicator shows at a glance whether the product is over size, under size, eccentric, tapered, or if lead error exists. Gaging results are recorded visually to accepted ring gage tolerances, thus eliminating the human error of "feel."

External threads in all classes from No. 0 through 3 1/8 inches in diameter, of either coarse or fine pitch, can be gaged. The design permits checking up to twenty pieces per minute. Only three minutes is required to change thread diameter units. The indicator is equipped with tolerance hands and is graduated to check within accuracy limits of 0.0002 inch. 71

Bellows Air-Motor Arbor Stand

The Bellows Co., Akron, Ohio, has brought out an air motor arbor stand designed to make a light-duty air press out of a standard Bellows air motor, for performing riveting, stamping, marking, and similar operations. The complete arbor stand consists of an upright arbor and base, which can be purchased either separately or assembled.

Any one of four Bellows air motors can be mounted on the arbor in less than two minutes. The controlled thrust and piston speed available from the air motor, with its built-in valve and speed controls, provides a range of "squeeze" pressures from a few pounds up to one-third of a ton, depending on the model air motor used and air pressure applied. 72

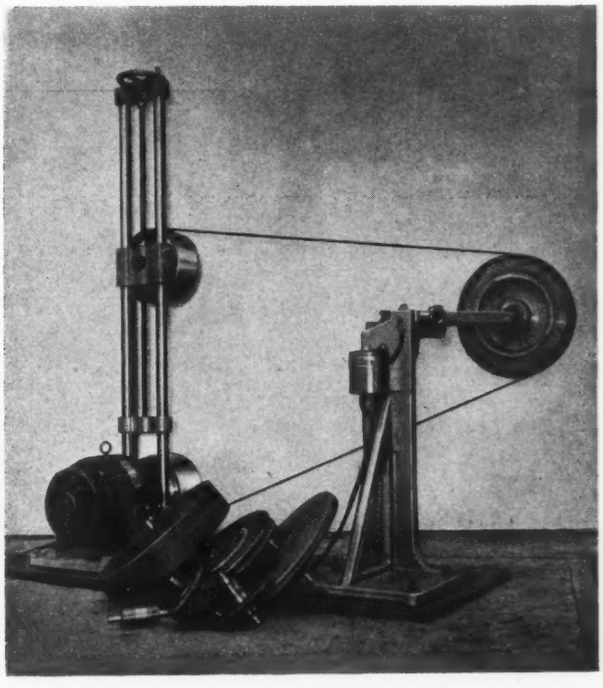
Bader Belt Grinding and Polishing Machine

Stephen Bader & Co., Rockville Centre, N. Y., has just introduced a new belt grinding and polishing machine equipped with a 2-H.P. reversible motor which permits reversing the direction of belt travel. Contact wheels from 1 1/2 to 18 inches in diameter, made from materials that vary in flexibility and softness, such as cloth, soft rubber, felt, sheepskin, hair, or wire can be used.

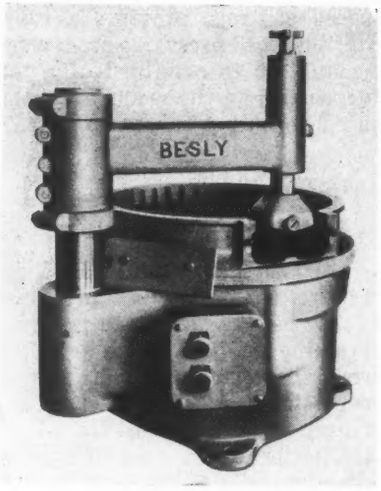
The wheels can be cut to any shape to suit the job. They are ball-bearing mounted, and being idler wheels, can be quickly interchanged. The adjustment feature of the rear pulley permits quick changing and accurate tension adjusting of the belts which range in length from 6 to 14 feet. The unsupported part of the belt, as well as the part supported by the contact wheel, can be used for polishing and grinding.

The machine has an over-all height of 5 feet. Front and rear units are separate, and can be mounted to suit individual requirements. 73

(Left) Bellows air motor, upright arbor, and heavy steel base. (Right) Members assembled to form air-motor press



Belt grinding and polishing machine with reversible drive, recently placed on the market by Stephen Bader & Co.



Besly free-hand bench grinder developed for light work

Free-Hand Bench Grinder for Light Work

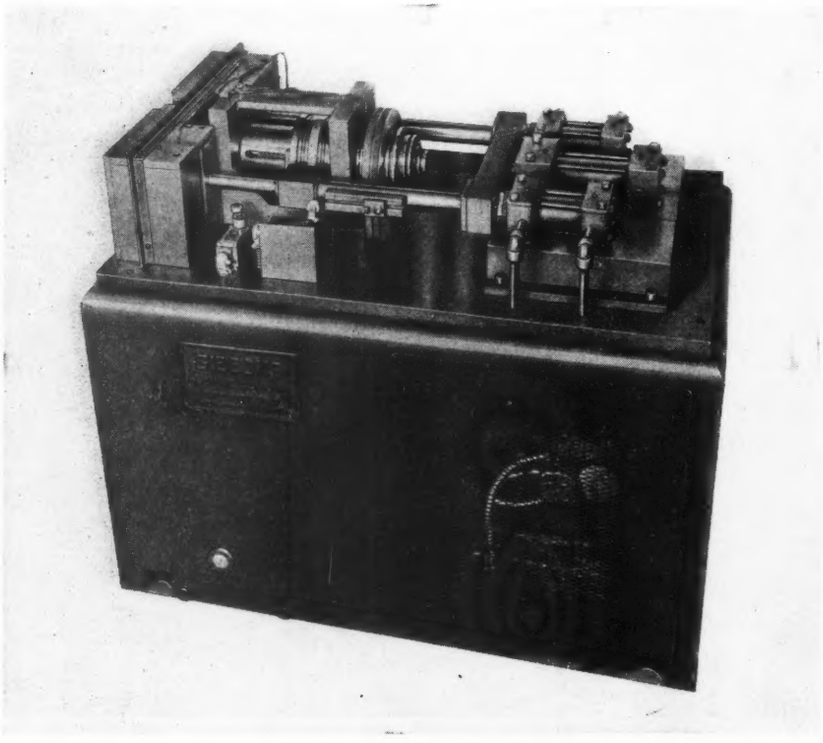
Free-hand grinding of castings, forgings, stampings, plastics, etc., where little stock removal is required can be done efficiently on a small, inexpensive bench model grinder recently brought out by Charles H. Besly & Co., Beloit, Wis. This new 18-inch vertical-spindle grinder has an approximate weight of 575 pounds. It is only 31 inches high and about 28 inches wide.

The grinder is designed around a Fairbanks-Morse axial air-gap motor of the compact "pancake" type. This three-phase, 60-cycle ball-bearing motor is totally enclosed, fan-cooled, and develops 5 H.P. at 1160 R.P.M. 74

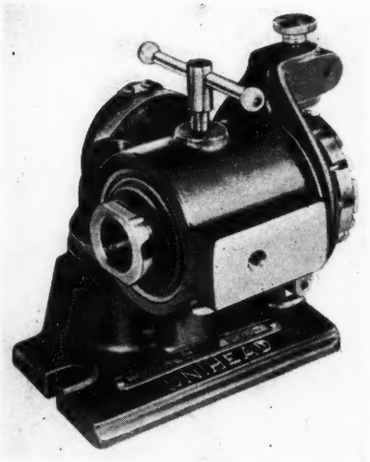
Gibbons Tube Beading and Flaring Machine

A new machine for beading tubing after it is bent is now being manufactured by the Gibbons Machine Co., Tipp City, Ohio. This machine makes use of a spinning principle, by means of which the tube is held stationary by blocks in the die while the profile spindle is rotated off center to form the bead. The height of the bead is controlled by the distance the profile spindle is rotated off center. A limit switch adjustment controls the "off center" distance. The profile spindle has a 1/2-inch "off center" throw and a one-shot oiling system.

The machine base is of welded steel construction, with starters, relay switches, and control valves mounted in a built-in compartment. A 7 1/2-H.P. and a 10-H.P. motor furnish power for operating the unit. The time cycle is adjustable by means of a flow control valve. 75



Tube beading and flaring machine manufactured by the Gibbons Machine Co.



"Unihead" adjustable work-head

Delta Work-Head

Flexibility in grinding spiral mills, end-mills, keyway cutters, and other types of cutters is provided by a universally adjustable work-head developed by the Delta Power Tool Division of the Rockwell Mfg. Co., Milwaukee, Wis. Though designed particularly for use on the swivel table of a Delta tool and cutter grinder, the "Unihead" can be used on other makes of machines when the Delta stop-tooth unit is employed with it.

The head consists of a sleeve having a No. 9 Brown & Sharpe taper and mounted in pre-loaded, sealed, lubricated-for-life ball bearings. An adjustable index-collar with a selector plate provides for indexing the work through two, three, four, six, or twelve equal spaces. A swivel bracket having 360 graduations is also available. 76

Hexagonal-Socket Pipe Plugs with "Dryseal" Threads

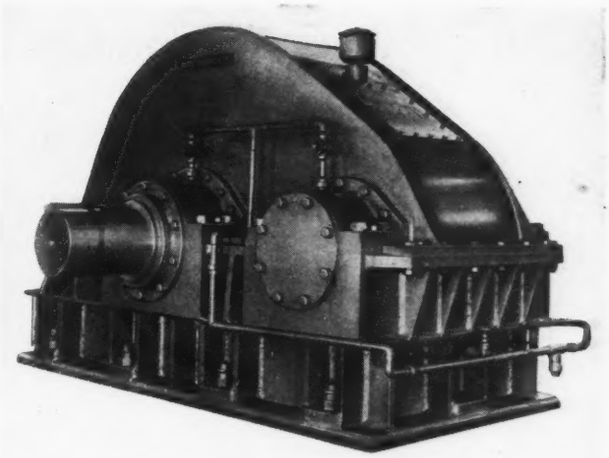
The U. S. Plug & Fitting Co., Cleveland, Ohio, has announced an improved special-alloy steel, brass, and aluminum hexagonal socket pipe plug with "Dryseal" threads in ten sizes ranging from 1/16 to 2 inches. The "Dryseal" thread is designed to eliminate leakage without the use of sealer compounds. 77

Electric Magnetic Chuck

The Continental Electric Co., Hawthorne, Calif., has announced a new Model C electric magnetic

To obtain additional information on equipment described here, use Inquiry Card on page 217.

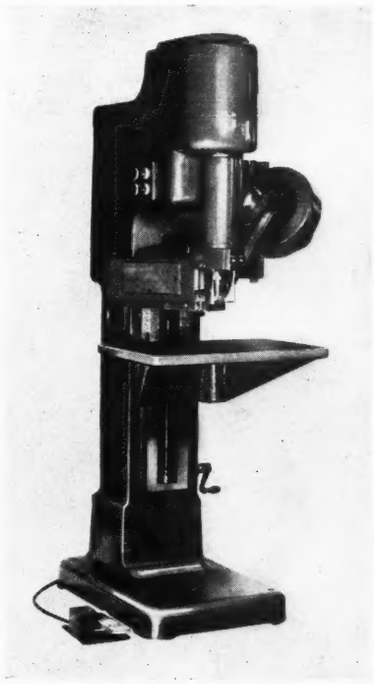
Electric magnetic chuck announced by Continental Electric Co.



Speed reducer brought out by the Westinghouse Electric Corporation

chuck designed for use on lathes. This chuck is said to have tremendous holding power, exerting a magnetic force or total pull of over 2 tons, which is applied in holding the work.

This unit is furnished complete with a control box, and can be connected to any 115-volt, 60-cycle circuit. The chuck can be plugged into the control box, which has two switches, one for energizing the surface of the chuck and the other for demagnetizing the holding surface. 78



Nut driving machine brought out by Detroit Power Screwdriver Co.

Westinghouse Speed Reducers

New single- and double-reduction industrial speed reducers in ratings up to approximately 3000 H. P. are now available from the Westinghouse Electric Corporation, Pittsburgh, Pa. Hardened gearing and pinion-shafts and fabricated steel housings are used in both the WSH and WDH type speed reducers. These units require minimum mounting space and effect substantial savings in weight.

The gearing is of the standard AGMA hobbed double-helical type, designed with a high helix angle for smoother operation and less vibration at higher speeds. Antifriction bearings are used throughout, lubrication being provided by a positive splash system. 79

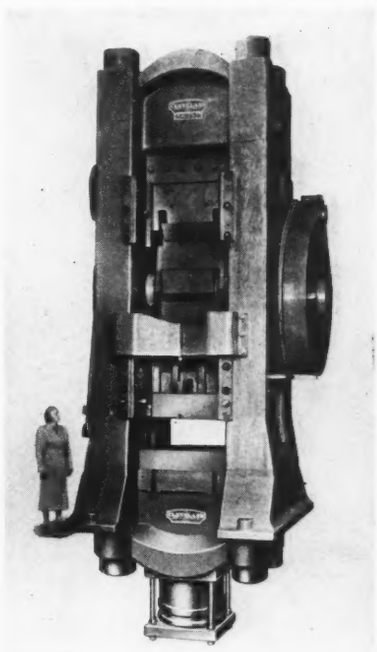
Nut Driving Machine

The Detroit Power Screwdriver Co., Detroit, Mich., has announced the development of a machine designed for driving nuts semi-automatically or automatically. This new machine will eliminate manual handling of the nuts, except for the periodical loading of the rotary barrel type hopper. The hopper keeps the machine continuously charged with nuts and feeds them to the driving spindle. With this arrangement, the operator handles only the parts to be assembled, which he places in the locating fixture, mounted on the work-table of the machine.

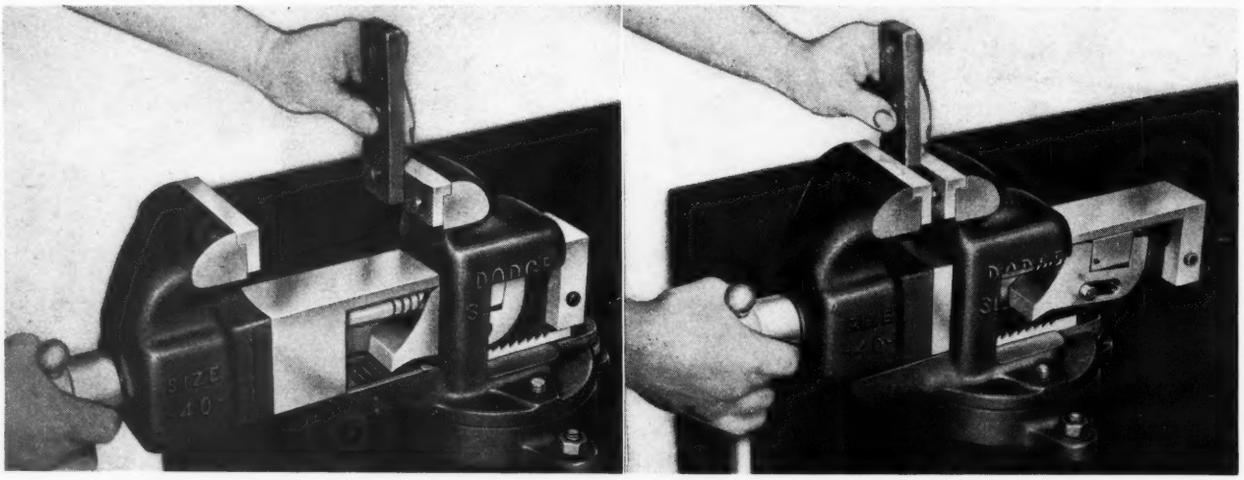
The machine has a capacity for driving nuts ranging from 5/16 to 11/16 inch across flats. It will handle special nuts such as "jam," castellated, lock, etc. 80

Cleveland Knuckle-Joint Press

A double-geared, twin-drive, knuckle-joint press has been introduced by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. This press is equipped with an air friction clutch and bar knock-out in the slide and has an air cushion in the bed. Pads are provided on the upright rear of



Knuckle-joint press introduced by the Cleveland Punch & Shear Works Co.



Dodge quick-action "Slide-Set" vise with housings cut away to show operating mechanism

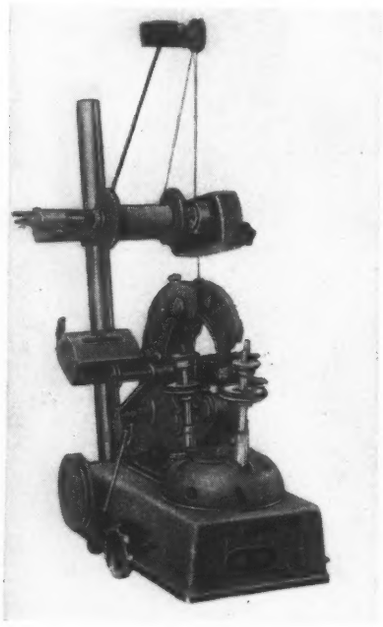
the slide for a mechanical pick-off attachment.

The new press has a slide stroke of 10 inches; slide adjustment of 1/2 inch; shut height of 30 1/2 inches; slide face, 30 by 36 inches; bed area, 42 by 48 inches; speed, 14 R.P.M.; and capacity, 2500 tons. The cushion has a capacity of 50 tons at an air pressure of 75 pounds per square inch and a travel of 3 inches.....81

Toroidal Coil Winding Machine

The Cosa Corporation, New York City, has placed on the market a toroidal coil winding machine built by Micafil Ltd., of Zurich, Switzerland. This machine is provided with coil supports for either high-speed continuous winding around the entire core or sector winding up to 270 degrees.

The new machine automatically winds coil wire around toroidal or sector cores, placing each strand close to the next one, or accurately spacing them, as desired. The shuttle has large wire storing capacity, and is loaded at twice the normal speed while the coil remains in position. The motor is equipped with a control for stepless adjustment of angular feed during operation. The winder also has an adjustable reverse feed and foot-pedal control. 82



Toroidal coil winding machine introduced by Cosa Corporation

Dodge Quick-Action "Slide-Set" Vise

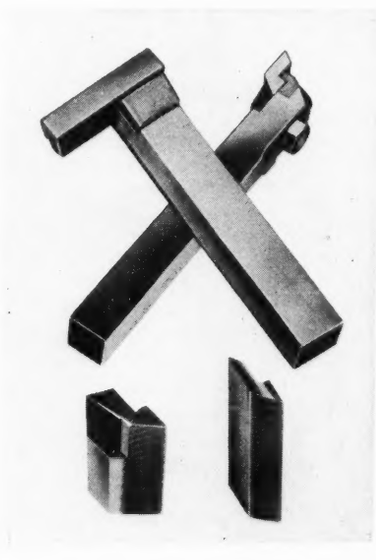
A machinist's vise embodying a patented fast slide action has just been announced by the Dodge Mfg. Corporation, Mishawaka, Ind. This new product, known as the "Slide-Set" vise, is now available in a 4-inch size, with either a swivel or a stationary base.

The vise can be opened or closed to any position in one second through a push-pull action which eliminates spinning. It weighs 58 pounds, and combines the ruggedness and power of a conventional type vise with the instant slide action, designed to reduce operator fatigue and increase efficiency on bench and assembly operation.

The slide action mechanism can be clearly seen in the cut-away views of the accompanying illustration. Turning the handle of the vise counter-clockwise serves to throw the parts of the quick-acting mechanism into the neutral position, shown in the view at the left, ready for fast sliding action in either direction. A push on the jaw of the vise serves to close it on the work, as shown in the view at the right. The clockwise movement of the handle then serves to apply full clamping pressure to the work. The vise handle is of a special "no-pinch" design.....83

Bokum Cutting Tools and Blades

A new line of engine and turret lathe turning tools combining blades and holders has been announced by the Bokum Tool Co., Detroit, Mich. Either high-speed steel or carbide-tipped blades are

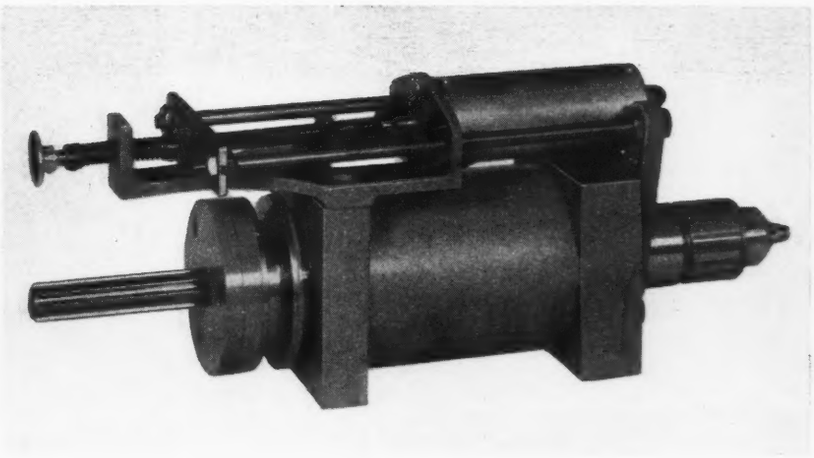


Cutting tool holders and blades brought out by Bokum Tool Co.

To obtain additional information on equipment described here, use Inquiry Card on page 217.

available for insertion in holders of heat-treated chromium-nickel steel. The tipped position of the blades in their holders is said to permit metal to be removed from the work at the highest possible speeds that can be used for steel or carbide cutters.

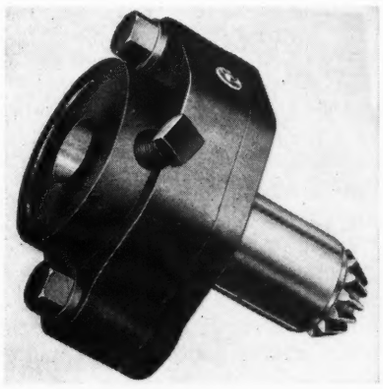
Six models have been developed for roughing; semi-finishing; finishing and straight shoulder turning; cutting off; standard threading; and automatic threading. The cutter blades can be easily and accurately resharpened and the holders replaced on the machine. 84



High-speed drilling and tapping unit brought out by HyPneuMat Inc.

Boyar-Schultz Deep-Hole Drilling Tool for Automatics

The Boyar-Schultz Corporation, Chicago, Ill., has recently placed on the market a new deep-hole drilling tool with a special oscillating action in the head of the holder. This action breaks the chips up into small particles, which are dissipated along the flutes of the drill. Thus drilling time is shortened because the usual frequent "pull-outs" are avoided, and drills last longer because of reduction in friction caused by chips. Another feature of the tool is that it is adjustable to compensate for misalignment between turret and spindle.



Boyar-Schultz deep-hole drilling tool

Holes in free-machining, stainless, and commercial tool steels can be drilled to a depth of approximately seven to ten times the diameter of the drill.

This tool is available in three sizes for automatic screw machines, and is adaptable for use on multiple-spindle machines. 85

High-Speed Drilling and Tapping Unit

A high-speed precision automatic drilling and tapping unit that utilizes either hydraulic or pneumatic power, designed for either one-stroke or continuous-cycling operation, has just been introduced by HyPneuMat Inc., Milwaukee, Wis. The unit has a rotating and reciprocating spindle, and can be operated at speeds up to 20,000 R.P.M. The drilling and tapping capacity is 3/8 inch in steel, and the stroke 1/8 inch to 3 1/2 inches.

Features include automatic cycling; infinite adjustable feed; adjustable stroke in both directions; variable spindle speed; uniform smooth power; easy installation; automatic, hand, or foot control; dwell action adjustable from 0 to 120 seconds; and chip cleaning action. The unit can be used for light, precision, and heavy-duty work. 86

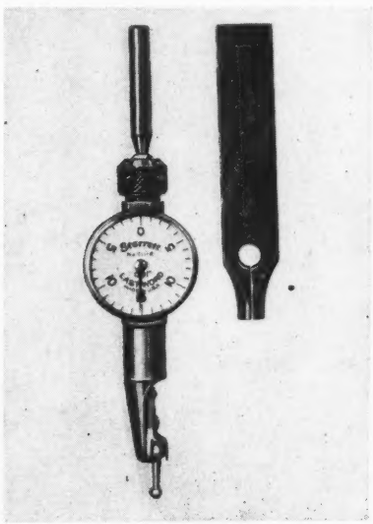
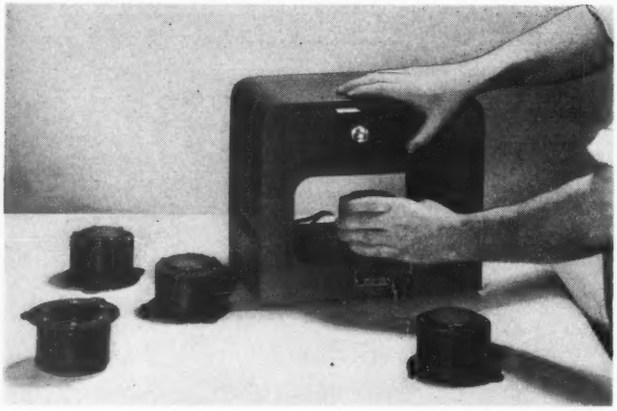


Fig. 1. Test indicator brought out by the L. S. Starrett Co.

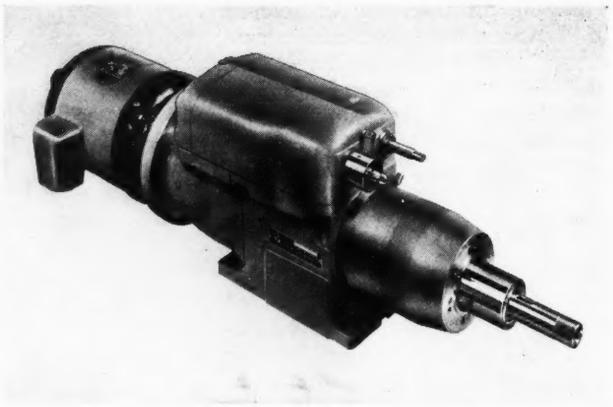
Starrett Test Indicator and Shock Absorbing Anvil

The L. S. Starrett Co., Athol, Mass., has recently added a new test indicator and shock absorbing indicator anvil to its line of instruments for machinists and toolmakers. The No. 711-E "Last Word" indicator, Fig. 1, has new features and attachments developed to adapt it for precise indicating on a wide range of machining, laying out, checking, and inspection work. The universal swivel friction holder on the end of the indicator body permits it to be used in the chuck of jig borers, milling machines, or boring machines. Additional features include a switch lever on the body

Fig. 2. New Starrett shock absorbing anvil for dial indicators



Demagnetizer brought out by the General Electric Co.



Air-hydraulic drill unit made by Delta Mfg. Division

for reversing the action; hard chrome-plated contact point with ratchet joint which permits instant movement to any position; and removable inspection hole cover screw for making minor adjustments. This indicator has a range of 0.030 inch, and is graduated in thousandths of an inch.

The new shock absorbing anvil shown in Fig. 2 provides a simple, inexpensive means for converting any standard dial indicator with solid type contact point into a shock absorbing indicator which will be highly resistant to damage from impact blows. The thread size on the new indicator point is No. 4-48 which is the AGD standard. 87

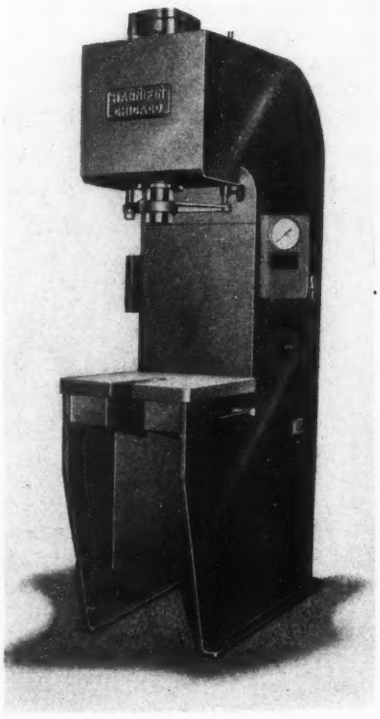
Hannifin Hydraulic Forcing Press

The Hannifin Corporation, Chicago, Ill., is placing on the market a 10-ton hydraulic forcing press having an 18- by 20-inch table located 36 inches above the floor. Standard models have a 3-inch U-slot in the table. The gap or daylight space is 22 inches and maximum stroke 12 inches.

This press is completely self-contained. It has a 5-H.P. vertical motor and a constant-volume pump with a capacity of 11 gallons per minute. An adjustable relief valve makes it possible to set the maximum pressure at any point from 10 per cent of capacity to the full 10-ton capacity. Single manual lever control is standard equipment, but dual manual lever control and sensitive pressure control are both available. A differential circuit which doubles the approach speed without limiting the feed pressure or return speed is also available.....88

General Electric Demagnetizer

An improved demagnetizer coil has been announced by the General Electric Co., Schenectady, N. Y. This equipment is designed for demagnetizing materials and stabilizing magnetic flux. It will demagnetize any unshielded magnetically soft material, including iron and steel. It can also be used to eliminate magnetic flux from tools, drills, punches, small arms, and any machined parts that may have become magnetized. Another application is for equalizing and stabilizing magnetic flux in permanent-magnet assemblies. 89



Hannifin hydraulic forcing press

Delta-Milwaukee Air-Hydraulic Drill Units

Air-hydraulic drill units made by the Delta Mfg. Division, Rockwell Mfg. Co., Milwaukee, Wis., are now available in a variety of sizes and capacities to meet a wide range of drilling, reaming, boring, chamfering, and similar operations. The No. 19-150 unit has a capacity for drills from a No. 80 to 5/16 inch in diameter, with a spindle travel of 1 1/2 inches and maximum spindle thrust of 400 pounds at an air line pressure of 80 pounds per square inch.

The No. 19-400 unit handles drills up to 1/2 inch in diameter and has a spindle travel of 4 inches. Holes up to 1 inch in diameter can be drilled with the No. 19-600 unit, which has a spindle thrust of 1200 pounds and a spindle travel of 6 inches. Motors range from 2 to 5 H.P.

These units all employ an electric motor to rotate the spindle; air pressure to feed or force the spindle forward; and oil pressure to accurately control the spindle rapid approach and power feed.

The units can be wired for electric remote control and arranged for either semi- or full-automatic operation by the use of a solenoid-operated four-way air valve or for manually cycling by a foot- or hand-operated four-way air valve. They can be had adapted for direct drive, gear reduction drive, or pulley drive. 90

"Bost-Bronz" Oil-Impregnated Bearings

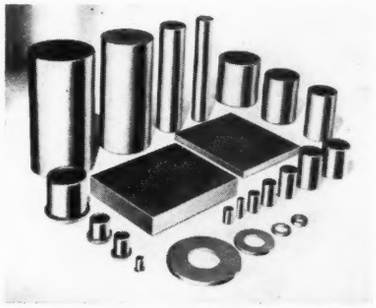
A new line of all-purpose, precision-sized porous bronze bearings, cored bars, and solid bar and plate

To obtain additional information on equipment described here, use Inquiry Card on page 217.

stock in a wide range of sizes has been announced by the Boston Gear Works, Quincy, Mass.

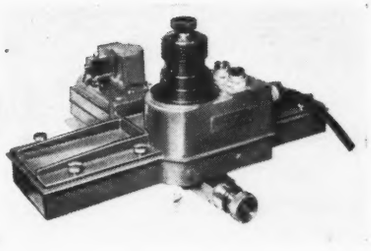
The new "Bost-Bronze" bearings carry their own oil reservoirs, which provide an oil film on all surfaces. Relubrication is effected by simply applying oil to the surface which absorbs it by capillary attraction, the same as blotting paper absorbs ink.

Plain cylindrical bearings are stocked in 1/8 inch to 3 inches inside diameter sizes; flanged



Oil-impregnated bearings, bars, and plate stock brought out by Boston Gear Works

bearings from 3/16 inch to 2 inches inside diameter; thrust bearings from 1/4 inch to 1 1/2 inches inside diameter; cored bar stock from 1/2 inch inside diameter by 1 inch outside diameter up to 4 inches inside diameter by 6 inches outside diameter; solid bar stock from 3/8 inch to 4 inches outside diameter; and plate stock from 1/8 to 1 inch thick. "Bost-Bronze" parts can be readily machined by tungsten-carbide or similar tools, using feeds and speeds commonly employed for bronze. 91



Hoglund "Magni-Form" automatic contour wheel-dresser

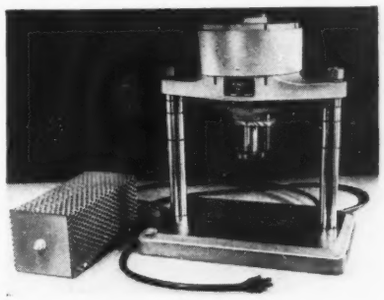
Hoglund "Magni-Form" Automatic Contour Wheel-Dresser

A precision "Magni - Form" wheel-dresser, designed for use in production contour grinding, has just been announced by the Hoglund Engineering Co., Inc., Union, N. J. This dresser, when equipped with a 10 to 1 ratio templet, is said to enable unskilled operators to hold production contour grinding work within limits of less than 0.0001 inch. Continuous dressing speeds range from 5 to 40 inches per minute.

The contour is dressed on the wheel at the correct height and position relative to the holding fixture, thus eliminating all resetting of the grinder between dressing operations. The dresser is especially adapted for use in grinding spline and gear tooth profiles, accurate instrument cams of complicated forms, etc. It is permanently mounted on the right-hand end of the table and does not interfere with the normal use of the grinder. Stampings are also being ground to advantage with this dresser, eliminating the need for shaving dies. 92

"Electropress" Impact Hammer with "Squeeze" Action

Black & Webster, Inc., Needham, Mass., have added a heavy-duty production tool to their line of electrical impact hammers known as "Electropunches." The new type hammer, designated "Electropress," not only delivers an impact blow up to 6000 pounds (calculated on work done through



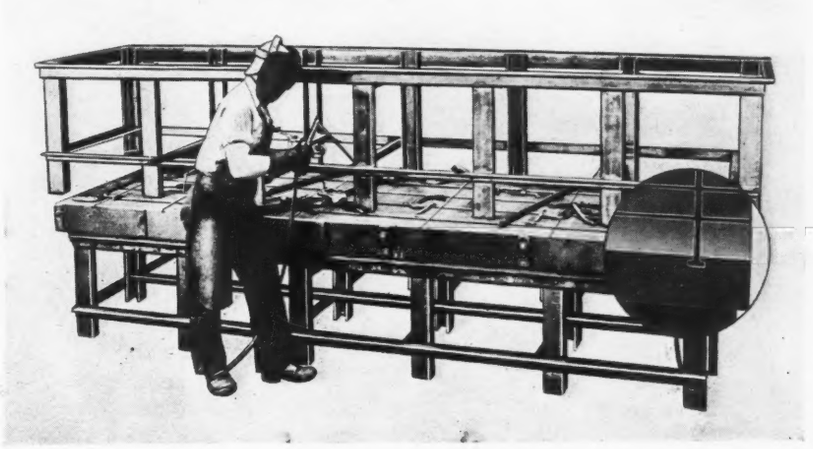
Black & Webster Electropress designed to deliver impact blow followed by squeezing action

a distance of 1/64 inch), but also exerts an additional "squeeze" or pressure of 2000 pounds at the end of the stroke. Both impact and pressure can be easily controlled by an "impact control" unit.

The combination impact blow and squeeze provided by the new Electropress especially adapts it for high-speed forming, crimping, marking, bending, riveting, punching, and similar operations. The machine can be operated from any 115-volt alternating-current supply line. 93

Challenge Welding Table

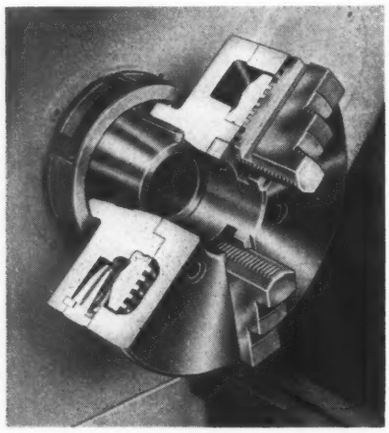
Semi-steel welding table recently added to the line of equipment made by the Challenge Machinery Co., Grand Haven, Mich. The table is 6 inches thick, and provides a rigid, smooth, and square surface having T-slots to facilitate assembling, locating, and welding operations. Furnished with an arc-welded, all-steel stand, which makes a substantial base that has the strength and solidity of a one-piece unit. These tables are made in three standard sizes—30 by 60 inches, 48 by 96 inches, and 54 by 144 inches. Equipped with lock leveling screws for quickly leveling the table and locking it securely in position for the welding operation. 94

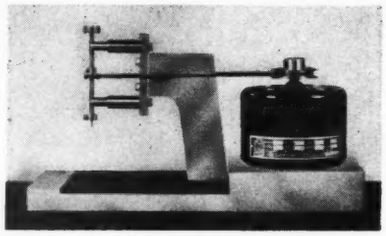


To obtain additional information on equipment described here, use Inquiry Card on page 217.

Universal Scroll Chuck

Universal scroll chuck with scroll bearing surface in back of chuck and other features designed to increase accuracy and strength, reduce weight, decrease set-up time, and provide greater safety. Interchangeability between spindles of the same type permits handling an infinite variety of round or hexagon rods and bars, as well as all types of concentric work-pieces within the range of the chuck. Made in sizes of 6, 8, 10, and 12 inches to fit various American Standard spindle noses. Announced by the Union Mfg. Co., New Britain, Conn. 95





Walcon Micro Drilling Machine

Micro drilling machine designed for high production of precision holes as small as 0.0016 inch in diameter with a minimum of drill point breakage. The only moving part in this new drilling machine is the spindle, which runs in bronze oilless bearings of the vee type and is held in perfect alignment by an endless rubber belt. Any wear which might develop between the spindle and the bearings is automatically taken up by the pull of the belt. The angle of the belt drive is such that a constant upward force is exerted on the spindle, which prevents the drill point from being pulled into the work and broken. This machine is especially adapted for drilling Diesel injection nozzles, atomizers, watch and clock parts, jets, and hypodermic needles, etc. Manufactured by Walcon Engineering Co., and distributed by Dudley Cohen, New York, N. Y. 96

"Dero" Precision Grinding Attachment

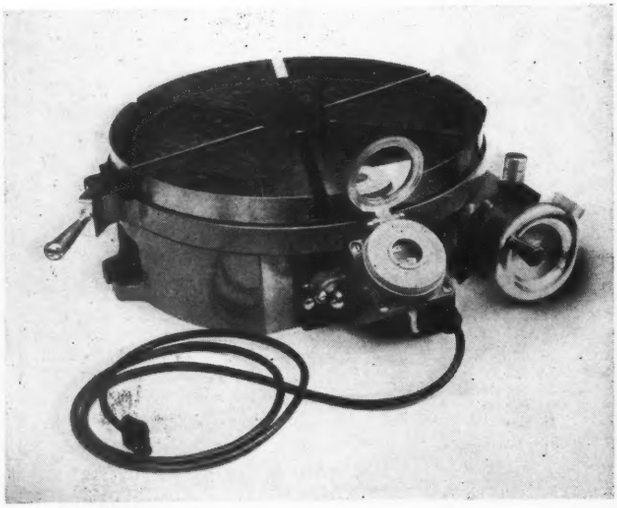
New "Dero" precision grinding attachment for internal and external grinding on lathes. Two models are available, one with a vertical adjustment up to 1 5/8 inches, and the other with a vertical adjustment of 3/4 to 7/8 inch. Grinding wheels up to 4 inches in diameter with face widths to 3/8 inch can be used, the wheel bores being 3/8 inch in diameter. Speeds range from 2000 to 10,000 R.P.M. Available through the Cosa Corporation, New York, N. Y. 97

Griswold Optically Controlled Rotary Indexing Table

Rotary 16-inch diameter, optically controlled indexing table designed for use on the larger sizes of milling machines, jig borers, and grinders. The built-in optical control enables angular settings in degrees, minutes, and seconds to be made from a master graduated reference drum within the table. Spindle run-out is held to within 0.0002 inch, and maximum error in indexing is said not to exceed 0.0005 inch measured at the periphery of the platen. Made by F. T. Griswold Mfg. Co., Wayne, Pa. 98

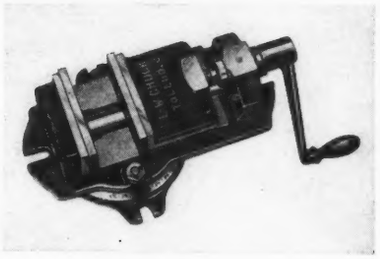
Colorama Magnifying Lenses for Visual Inspection

Colorama lenses consisting of large, clear, flexible magnifiers for aiding visual inspection and facilitating parts assembly operations. Designed to provide free and easy access for operator's movements and comfort. Adjustable to any angle. A fluorescent lamp provides illumination of the work. These lenses are 12 inches in diameter and are available in 3, 6, and 8 power. They are distributed by Engineers Specialties Division, Universal Engraving & Colorplate Co., Inc., Buffalo, N. Y. 99

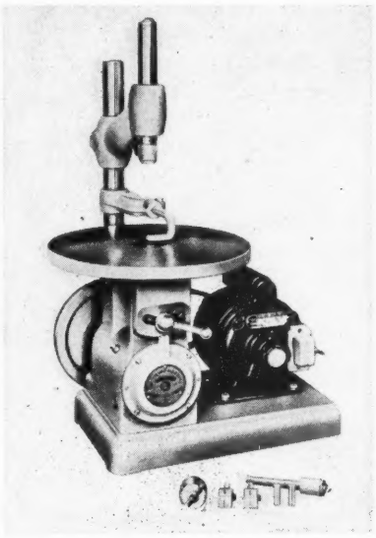


To obtain additional information on equipment described here, use Inquiry Card on page 217.

Die Filing Machine



Improved model die filing machine brought out by the Illinois Tool Works, Chicago, Ill. New features include easier operation, improved chucking arrangement for files, saws, and stones, and a more efficient lubrication system. Especially adapted for precise, rapid filing of intricate die contours. Operates on 110-volt, 60-cycle alternating current. Standard operating speed is 375 to 500 strokes per minute. 100

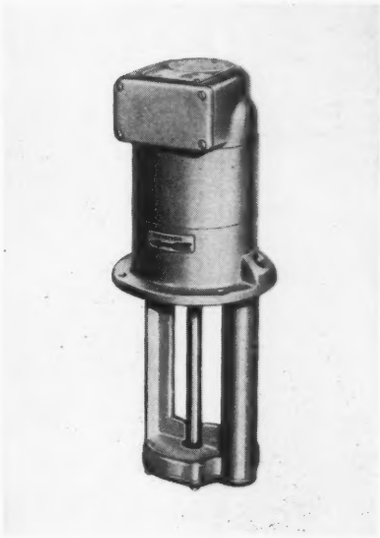


Swivel-Base Milling Machine Vises

Swivel-base milling machine vise of improved design recently developed by the L-W Chuck Co., Toledo, Ohio. Built of semi-steel castings in 3-, 4 1/2-, and 6 1/2-inch sizes. Hardened steel sliding jaws with full-length bearing on a ground bar and machined ways provide strength and accuracy. The 4 1/2- and 6 1/2-inch sizes have a large Acme steel screw with replaceable bronze nut, and weigh 40 and 85 pounds, respectively. The 3-inch size weighs 16 pounds. 101

Ruthman Gusher Coolant Pump

New gusher pump for machine tool coolants, designated Model 6 P3, just added to the line of pumps manufactured by the Ruthman Machinery Co., Cincinnati, Ohio. The impeller housing, spacer supports, mounting flange, and lower motor end bell are combined in one casting. This construction simplifies mounting in tanks and machine bed plates by the elimination of piping within the reservoir. The 1/10-H.P., 3450-R.P.M. motor is equipped with permanently lubricated ball bearings. The rotating assembly is dynamically balanced. This pump can be furnished installed in standard portable tanks, which can be had either with or without casters. 102

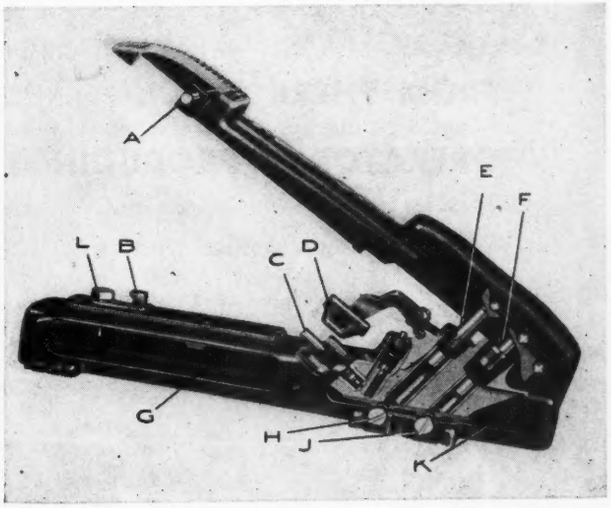


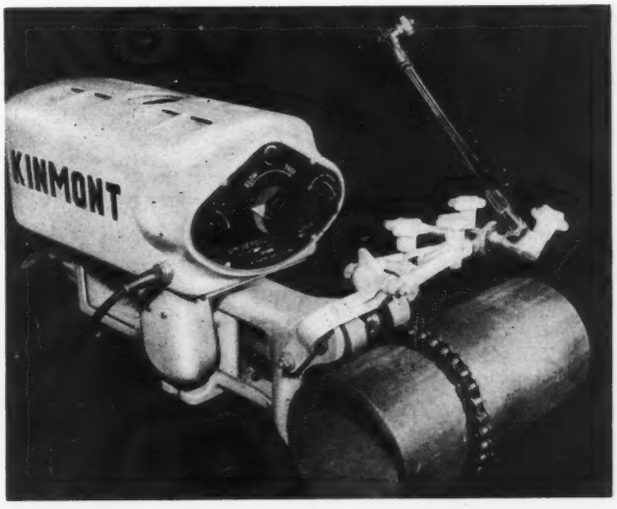
Foot-Operated Hydraulic Jack

Foot-operated hydraulic pump unit, called "Go Jak," which develops up to 20 tons pressure. This unit is adapted for use in assembling or disassembling large parts and for other repair shop work. The foot-lever has a stroke of 10 inches and is provided with a locking pin (A) and latch (B). There is a variable control valve (C), foot-release pedal (D), speed piston (E), power piston (F), oil reservoir (G) and filler cap (L), oil filters (H) and (J), and recoil spring (K). The complete unit weighs only 10 pounds and is threaded to take 3/8-inch pipe fittings. Placed on the market by Wihtol Industries, Eatontown, N. J. 103

Pipe-Scarfing Attachment

New versatile pipe-scarfing attachment developed for use with the Kinmont universal power unit, manufactured by Roylyn, Inc., Glendale, Calif. This accessory provides an economical means for accurately cutting or scarfing pipe or cylindrical tanks while they are being rotated by the power unit. It is easily installed through existing bolt holes. Provision is made for vertical and horizontal adjustment of the cutting torch, and a protractor dial, provides for angular adjustment. The scarfing attachment is conveniently hinged to permit swinging the torch out of the way while changing the work without disturbing the adjustment. 104





a SINGLE trial grind instead of MANY!

with the ELECTRALIGN

Here's the simple set-up procedure for grinding machines equipped with ELECTRALIGN, the exclusive Brown & Sharpe development for swivel table alignment:

(a) *operator inserts piece in grinding machine and makes the usual machine setting . . .*

(b) *preliminary grind is taken . . .*

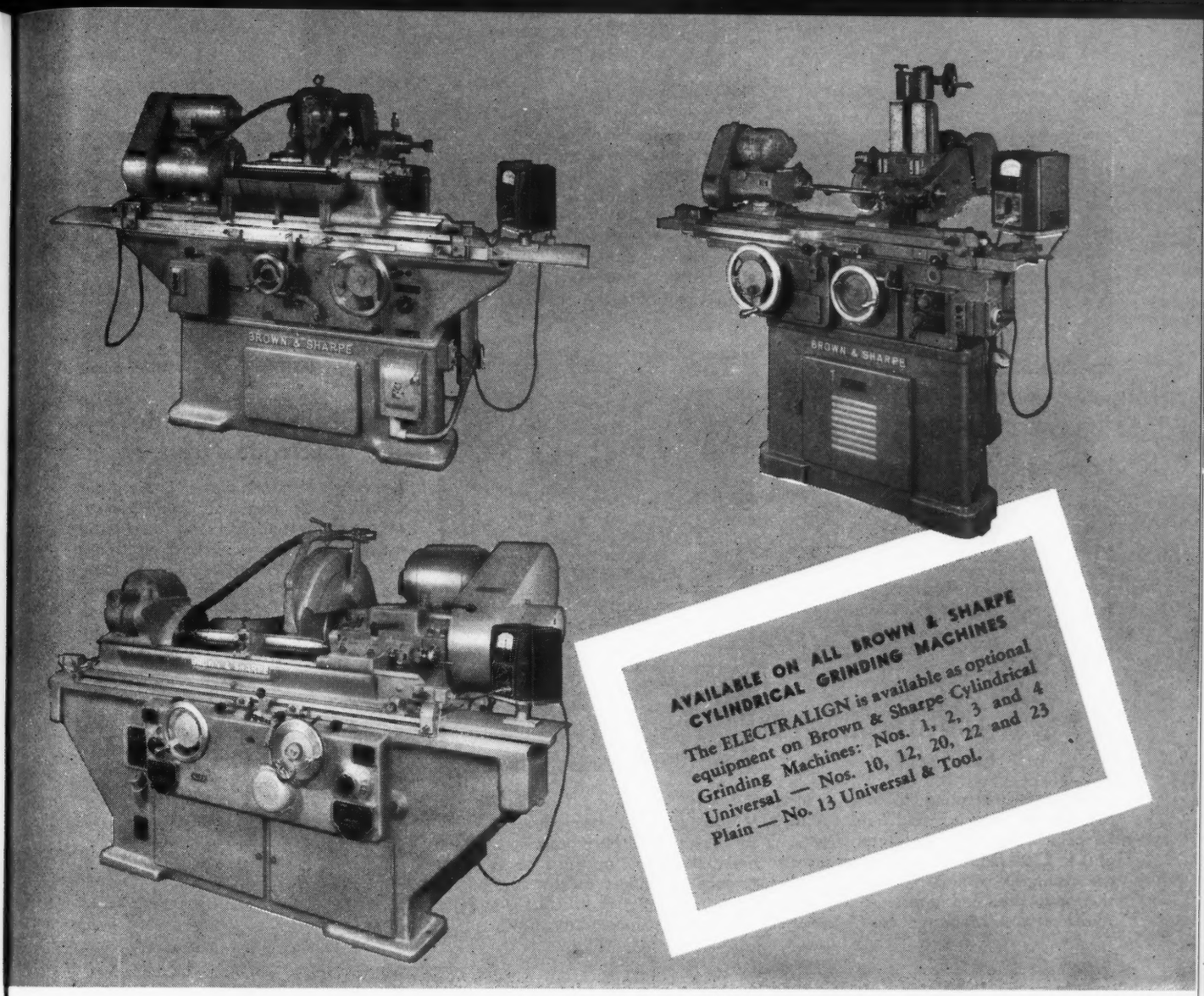
(c) *measurement is made of the amount by which piece deviates from desired straightness or taper . . .*

(d) *after the meter pointer has been set to the amount it is desired to swing the work, the operator makes a single positive correction by adjusting the swivel table until ELECTRALIGN needle reads zero . . .*

FROM THERE ON . . .

OPERATOR IS PRODUCING!

BROWN &


BROWN & SHARPE
BROWN & SHARPE
BROWN & SHARPE
AVAILABLE ON ALL BROWN & SHARPE CYLINDRICAL GRINDING MACHINES
The ELECTRALIGN is available as optional equipment on Brown & Sharpe Cylindrical Grinding Machines: Nos. 1, 2, 3 and 4 Universal — Nos. 10, 12, 20, 22 and 23 Plain — No. 13 Universal & Tool.

ELECTRONIC ALIGNMENT OF SWIVEL TABLE

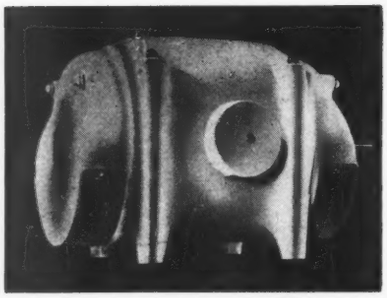
Setting the swivel table of a grinding machine to grind a straight shaft or an exact taper always has been a difficult cut-and-try operation. But it needn't be any longer! ELECTRALIGN makes it a simple, quick, direct job by measuring electronically the small angular movement of the grinding machine swivel table relative to the sliding table and magnifying it visually on the amplifier. A single realignment then gives the final precise table setting.

Full specified tolerance for sizing — Electralign makes possible the virtual elimination of taper in a straight piece and allows the operator the full blueprint tolerance for sizing — with resulting lower grinding cost and less scrap.

Recognized as one of the greatest modern advances in grinding, ELECTRALIGN assures important savings in time, money and strain on operators. It speeds production and improves the quality of the product.

For additional details or illustrated Bulletin, write Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

SHARPE B·S

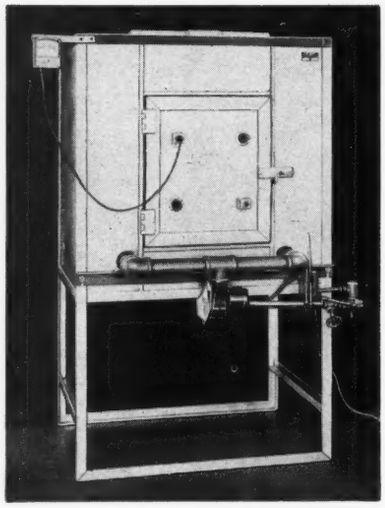


Splash-Proof Motor

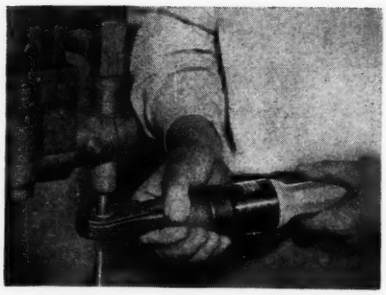
Screened splash-proof motor developed by U. S. Electrical Motors, Inc., Los Angeles, Calif. The screened ends of this new motor have openings located on the under side so that water cannot enter, yet they permit the full ventilation essential in motors ranging from 3 to 7 1/2 H.P. The motor is finished in baked white enamel and meets all sanitation codes. 105

Alpine Heat-Treating Furnace

Precision heat-treating furnace available in capacities ranging from 1.8 to 20 cubic feet, with temperature range of 0 to 2500 degrees F. These furnaces are equipped with porcelain-protected thermo-couples and direct-reading pyrometers with calibrated energy input and atmosphere proportioning. The draft type burner operates on natural, manufactured, or liquid petroleum gases. Safety is insured by means of a solenoid valve, with cuts off the fuel in the event that an electrical failure stops the blower, and then automatically relights and resets the fuel input when the failure has been corrected.



Multiple decks of any desired height can be used in the processing of small parts, thus assuring full loading of the furnace regardless of the size of the parts being treated. Introduced by A. D. Alpine, Inc., Culver City, Calif. 106

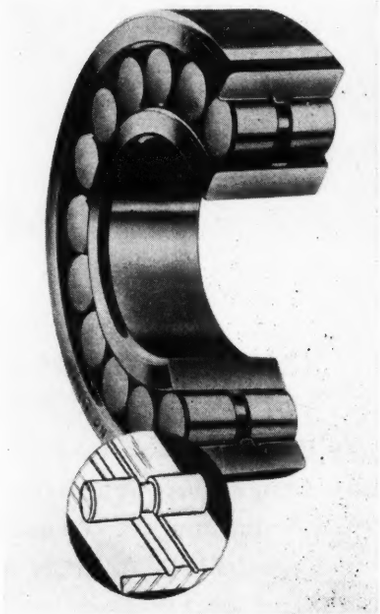


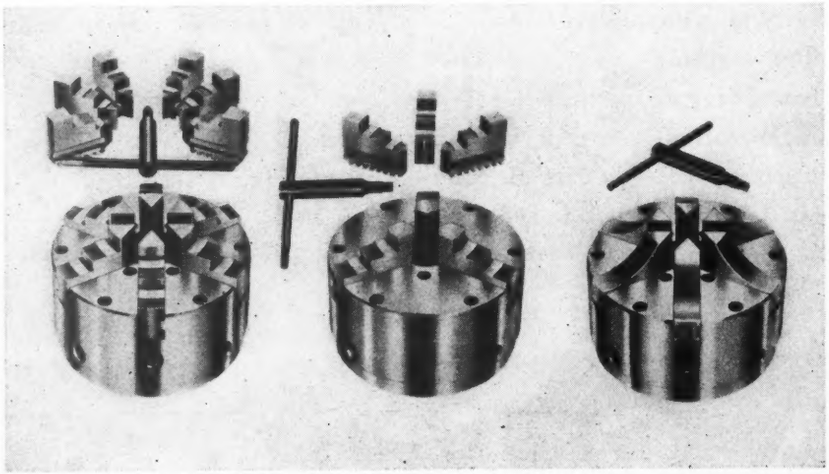
Keller Pneumatic Electrode Dresser

Pneumatic electrode dresser brought out by the Keller Tool Co., Grand Haven, Mich., to meet the demand for a rapid method of redressing round electrodes on single- or multiple-point welding machines. This tool combines the functions of both angle and thin type dressers, and is designed to restore electrodes to their original shape without removing them from the welding machine. The over-all length of the dresser is 12 3/4 inches and the net weight 4 1/2 pounds. 107

"Ajust-Tru" Self-Centering Chucks

Production of a new line of self-centering chucks with built-in adjustment for precision work has just been announced by the Buck Tool Co., Kalamazoo, Mich. This "Ajust-Tru" chuck is built to combine the flexibility and speed of a scroll chuck with the precision of a four-jaw independent chuck. It can be used for duplicate second operations without a second adjustment and will eliminate the need for collets, compensate for spindle run-out, and permit changing from one lathe to another. It can be adapted for use on dividing heads, screw machines, and grinders, minimizing the use of stub arbors, mandrels, and step collets. The line includes 4-, 5-, and 6-inch diameter sizes. There are three models—two with three and six external and internal stepped jaws and a six-jawed chuck for gripping external surfaces only. 108

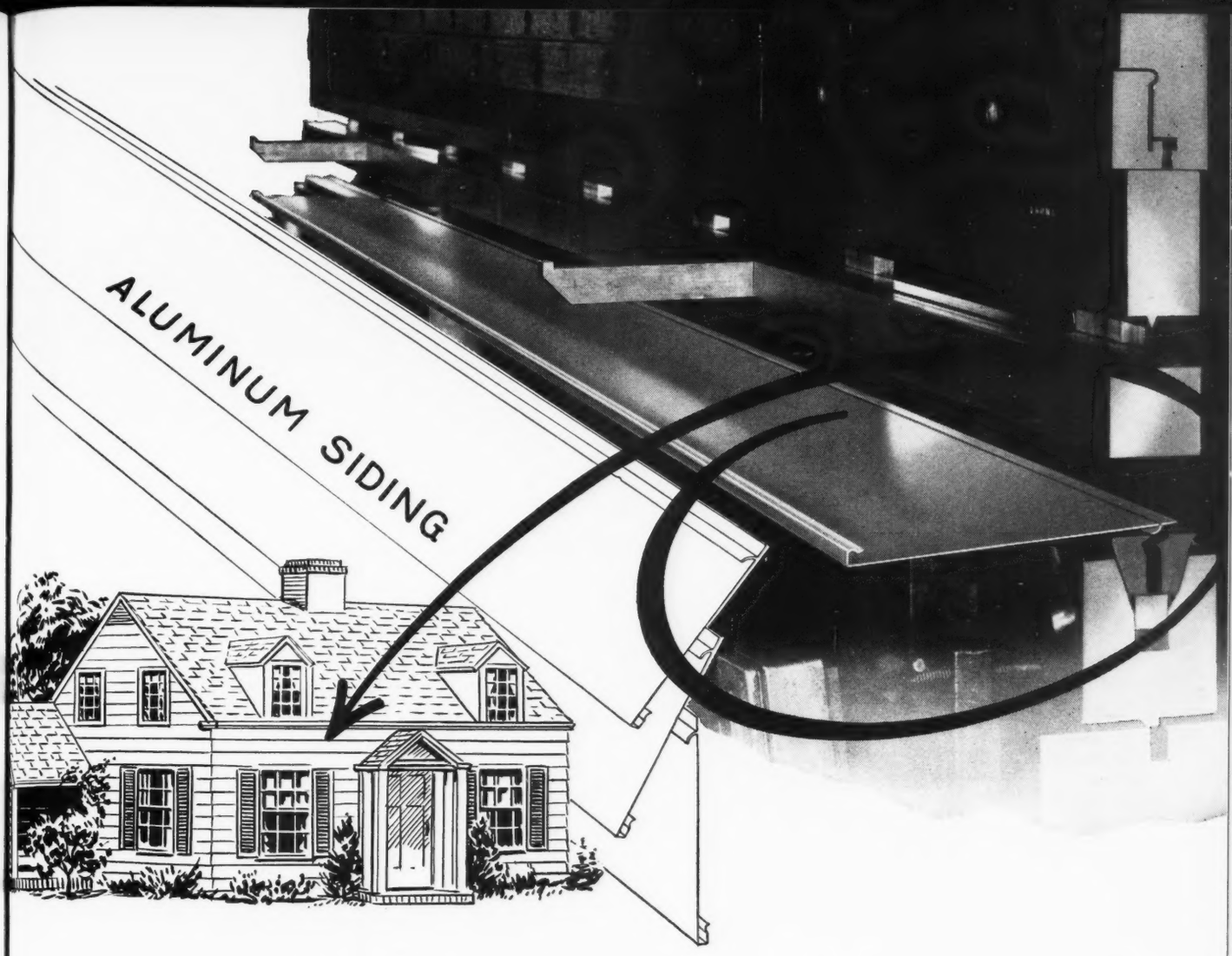




McGill "Guiderol" Roller Bearings

Cageless roller bearing designed to eliminate skewing of rollers. Produced by the Bearing Division of the McGill Mfg. Co., Valparaiso, Ind. The outer race of this bearing is constructed with a tapered guide rail on the inner surface. A retaining ring is snapped over the opposite side of the roller grooves to make the assembly self-contained. The rollers are grooved to match the guide rail. This bearing can be mounted in any position, from the horizontal to the vertical. 109

To obtain additional information on equipment described here, use Inquiry Card on page 217.



building industry uses

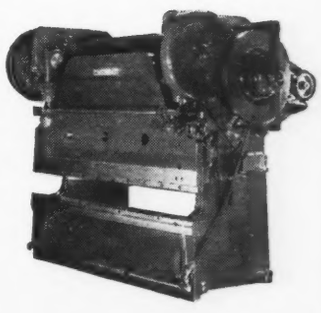
Cincinnati Press Brakes for multiple bends

Cincinnati Press Brakes are forming multiple bends in one hit on this aluminum siding—a high production item.

Economies—through speed, accuracy of performance and minimum handling—are giving low cost per piece.

Window and door frames, gutters, structural members and other items of the building industry are being produced on Cincinnati Press Brakes with parallel economies.

The unusual accuracy and great versatility of Cincinnati Press Brakes make them very profitable both for this production job and for jobbing work. Cincinnati Press Brakes produce a quality product at a low cost. They are a profitable investment.



THE CINCINNATI SHAPER CO.

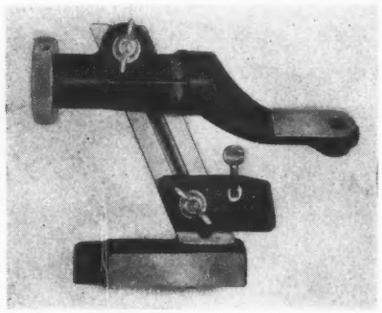
CINCINNATI 25, OHIO, U.S.A.

SHAPERS · SHEARS · BRAKES

Write for comprehensive, illustrated catalog—B-2-A—covering construction and many uses of Cincinnati All-Steel Press Brakes.

Grinding-Wheel Dresser

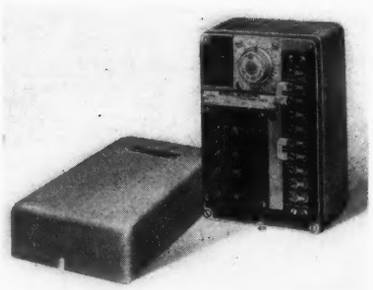
Grinding-wheel dresser that is applicable for angle, radius, or straight wheel dressing. Placed on the market by the Detroit Industrial Products Co., Detroit, Mich. One of the advantages claimed for this tool is that the diamond point is taken to the wheel instead of the wheel being raised or



lowered to the dresser. A radius arm will dress either concave or convex radii. Another diamond-holder is used for straight or angle dressing. All holes for diamond points are 7/16 inch in diameter. 110

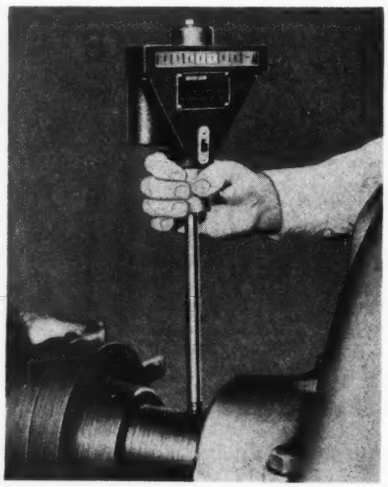
Portable Magnaflux Inspection Unit

Portable, general-purpose Magnaflux unit by means of which all defects such as invisible fatigue cracks, shrink cracks, weld cracks, etc., are made readily visible by magnetic particles built up on them by quick magnetization. Designed for a wide range of inspection. Built by Magnaflux Corporation, Chicago, Ill. 111



G-E Electronic Timer for Automatic Control

Electronic timer that provides automatic control of operation, limit, and sequence timing for industrial processes. Available in three time ranges—0.06 to 1.2 seconds, 0.6 to 12 seconds, and 6 to 120 seconds. Applications include electroplating, heat-treating, stopping of conveyor belts when material piles up, and sequence timing with two or more timers in combination to control the duration of operations on bearing grinding machines, rod-coiling machines, centrifuges, etc. Manufactured by the General Electric Co., Schenectady, N. Y. 112

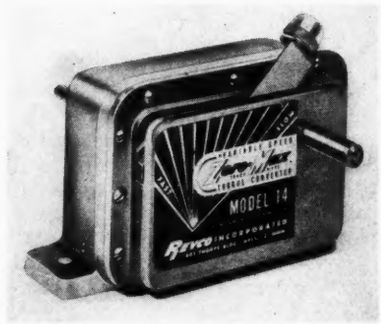


Davey "Vibrometer" for Measuring Amplitude of Machine Vibrations

Davey "Vibrometer" recently developed by the Vibroscope Co., New York, N. Y., for measuring the amplitude of machine vibrations. Applied by holding in the hands against the vibrating machine, the vibration amplitude is indicated by the width of oscillation of a light beam on a graduated ground-glass scale. Two models are available which magnify the vibratory motion 250 and 125 times. The source of light is provided by flashlight batteries housed within the instrument. A detachable probe 8 inches long is provided which can be used to contact the surface of a rotating shaft. 113

"Zero-Max" Transmissions

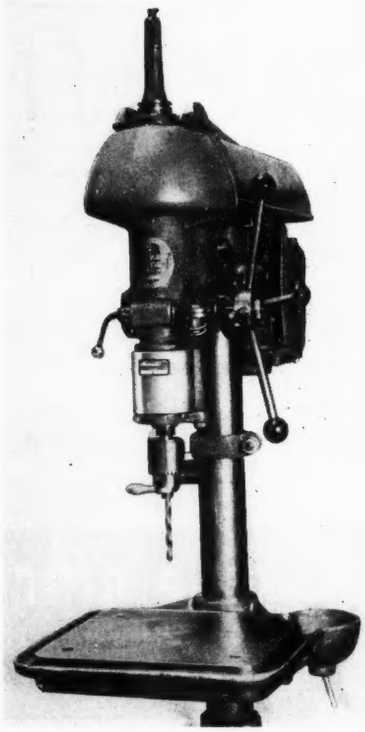
New model "Zero-Max" transmission announced by Revco, Inc., Minneapolis, Minn. Designed to provide stepless forward and reverse speeds from 0 to 425 R.P.M. at an input speed of 1750 R.P.M. This unit has a rating of 10 inch-pounds on the output shaft and can be used for operating throttles,



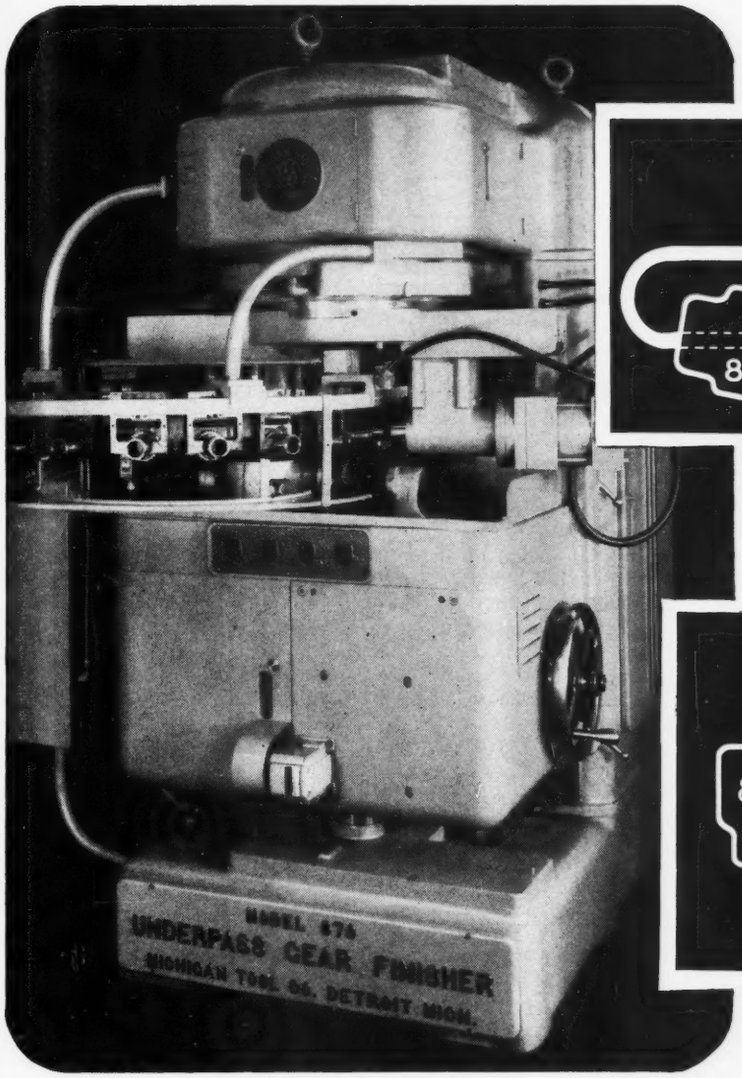
governors, and other controls. A larger model for use with motors from 1/15 to 1/4 H. P. is also available. 114

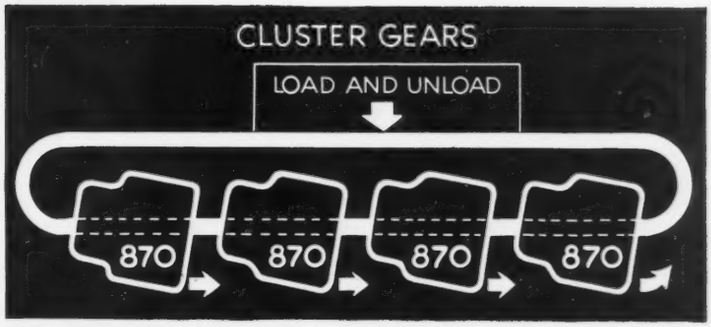
Pneumatic Drill Press Feed

Pneumatic drill press feed added to line of Modernair Corporation, Oakland, Calif. This single acting power unit, installed on the spindle of a drill press, permits controlled power operation. Controls may be for manual, semi-automatic, or automatic sequence with a simple three-way valve. An adjustable spring action furnishes power for the return stroke. 115

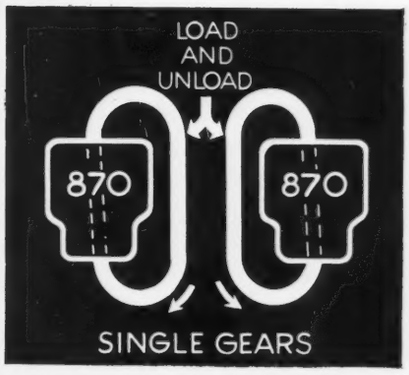


To obtain additional information on equipment described here, use Inquiry Card on page 217.





with conveyorized gear finishers



Michigan CUTS GEAR COSTS *Again!*

Gears can now be finished completely automatically ON A CONVEYOR—without manual or subsidiary mechanical machine loading.

Michigan's improved 870s are now so designed that conveyors can pass right THROUGH THE MACHINE. Each gear stops for a few seconds to be finished—then travels on with the conveyor.

Cycle time on the installation shown here is 17½ seconds for finishing—2½ seconds for conveyor movement between operations—20 seconds per gear TOTAL.

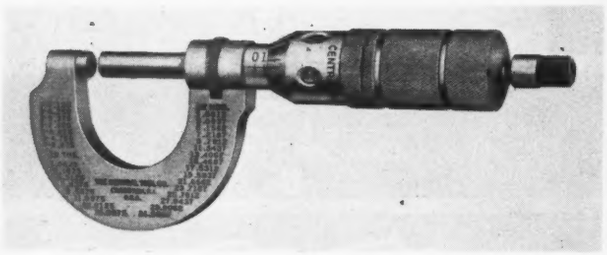
The same conveyor can be passed right through several 870 machines, if desired, to automatically finish all gears on a cluster.

Loading or unloading gears from the conveyor is simplicity itself. The touch of a finger separates the jaws which hold the gear. Remove the finger and the gear is securely supported. Finished gears are removed from the conveyor at any convenient location by the same light finger pressure.

We will be glad to have one of our representatives stop in with a complete set of photos and tell you more about this interesting development. Write to:

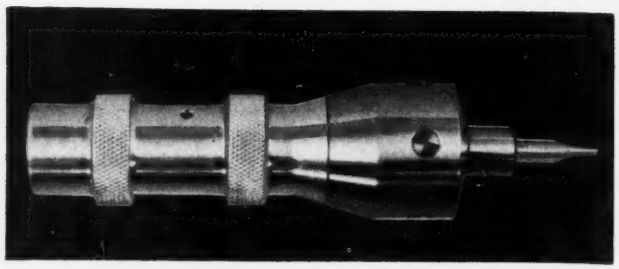
COMPLETE
from blank to finished gear
EQUIPMENT

MICHIGAN TOOL COMPANY 7171 E. McNichols Road Detroit 12, U.S.A.



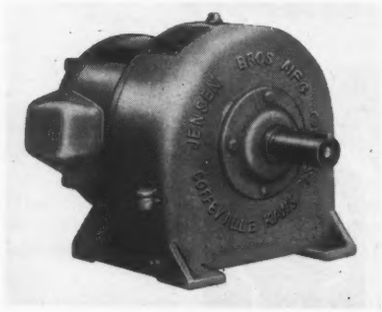
"Read-Rite" Micrometer

New micrometer caliper, known as the "Read-Rite," developed by the Central Tool Co. of Cranston, R. I. This micrometer has a window on the thimble through which numbers automatically appear, eliminating the computations usually required in micrometer reading. 116



Mechanical Torque Screwdriver

Mechanical torque screwdriver brought out by the Overload Control Co., Glen Oaks, Long Island, N. Y., which prevents threads from being stripped by automatically disengaging work when required torque is reached. Made in Model A for hand operation, and Model B for electric drill or drill press. 117

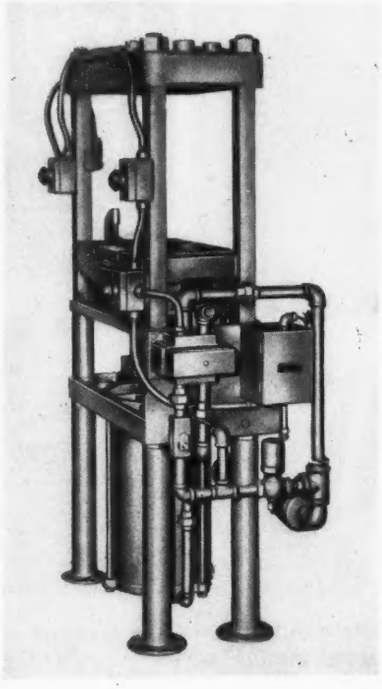


"Geartork" Planetary Gear Speed Reducer

Planetary gear speed reducer announced by Jensen Brothers Mfg. Co., Coffeyville, Kan. This compact speed reducer and motor unit, named "Geartork," is available in a variety of sizes from 1/2 to 10 H.P. The same sizes are available with double reduction gear trains. Flange mounted models have also been developed for special applications...118

General Electric "Tri-Clad" Single-Phase Motor

Repulsion-induction motor designed for use where a constant-speed, high-torque, single-phase motor is required in large ratings. The new Type SCR "Tri-Clad" motor combines the high starting torque of the repulsion motor with the constant-speed characteristics of the induction motor. Available in 5-, 7 1/2-, and 10-H.P. ratings, for operation at 1800 R.P.M. Typical applications include compressors, pumps, and stokers. Made by General Electric Co., Schenectady, N. Y. 119



Hannifin High-Speed Molding Press

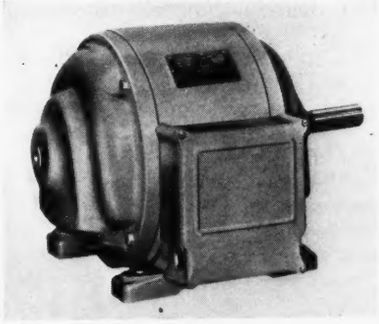
High-speed, semi-automatic air-operated platen type press for molding "Plaskon" alkyd resins, brought out by the Hannifin Corporation, Chicago, Ill. This press is compact, self-contained, and adjustable to molding speeds as high as two seconds. Special control for slowing down the platen at the instant of closing permits accurate molding of delicate parts. This new press measures 14 by 21 3/4 inches between columns and has a maximum stroke length of 7 inches. 120

Geared Key Chucks

Improved key chuck with one-piece construction of gear and threaded nut designed to provide maximum and positive gripping action. This new chuck is being introduced by Supreme Products, Inc., Chicago Ill. 121

Sterling Single-Phase Motor

Single-phase capacitor type motor recently added to the line of "Klosd" drip-proof motors made by Sterling Electric Motors, Inc., Los Angeles, Calif. Can be mounted on the wall or ceiling, as well as on the floor, and still retain the drip-proof feature by simply rotating the end-bells so that the air vent openings point downward. A newly designed starting relay eliminates the necessity of using centrifugal switches



To obtain additional information on equipment described here, use Inquiry Card on page 217.

ONE OIL DOES WORK OF TWO

Dual-Purpose Sunicut Replaces Two Former Oils; Dilution Ends; Finishes Improve; Tool Life Lengthens

When one oil does work formerly requiring two . . . and with marked superiority . . . it doesn't make good sense to keep on buying two.

That is precisely why a prominent ball bearing manufacturer changed to Sunicut. He had been using one oil for lubricating his automatics, and another for cutting, but without complete satisfaction. The lube oil kept diluting the cutting oil by leaking into it. As a result, he got poor finishes and tool life was short. A Sun representative, called in to study the situation, advised using a dual-purpose grade of Sunicut. Adoption of his recommendation solved the problem.

For three years now, Sunicut has been used by the entire automatic department with complete satisfaction. A year ago a switch was made to the *new* Sunicut with Petrofac, Sun's revolutionary all petroleum additive, and even better performance has resulted.

The new Sunicut grades, transparent and non-emulsifying, have been thoroughly "Job Proved." Excellent results are being obtained on automatics machining all types of steel and brass at all practical feeds and speeds. For further information, call or write your nearest Sun Office.

SUN OIL COMPANY · *Philadelphia 3, Pa.*
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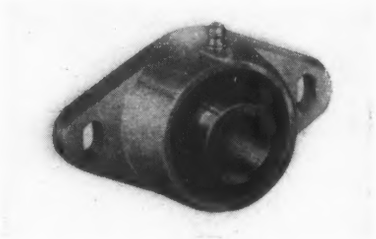
Toronto and Montreal

SUN PETROLEUM PRODUCTS

"JOB PROVED" IN EVERY INDUSTRY

SUNOCO®

or any rotating devices, such as throw-out switches, commutators, brushes, etc. This motor has a one-piece cast-iron stator frame, "herringbone" rotor, pre-lubricated ball bearings, and Vinol-acetal insulated stator windings. 122

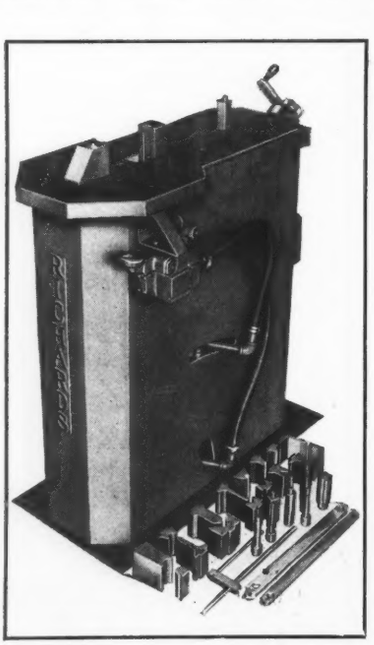


Ahlberg Ball-Bearing Flange Unit

The ball-bearing flange unit illustrated, designated the "FED Series," has been added to the line of ball bearings and mounted units manufactured by the Ahlberg Bearing Co., Chicago, Ill. It is designed specifically to meet the requirements of small shaft equipment, where light loads and normal speeds are imposed. The precision internal self-aligning ball bearings of this unit compensate for shaft deflections and mounting inaccuracies. 123

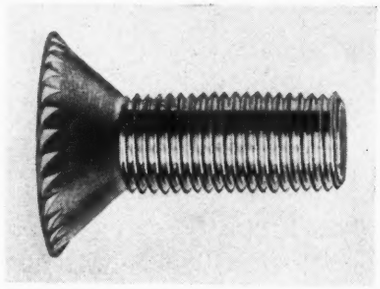
Richards Air-Operated "Multiform" Bender

New model air-operated "Multiform" bender equipped with four-way control valve brought out by J. A. Richards Co., Kalamazoo, Mich. This bender has a convenient working height of 39 inches, and is built in two sizes for handling material up to 1/4 by 3 inches or 1/4 by 4 inches. It is sold complete with dies and mandrels as illustrated. Special forming dies to suit requirements can be made from blanks furnished with dovetails. Finger-tip control by means of the four-way valve, using an air pressure of 105 pounds, gives ample power through the use of a toggle mechanism. 124



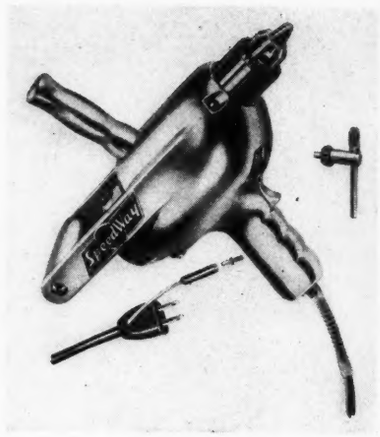
"Spin-Lock" Screw

"Spin-Lock" washerless screw made with hexagonal, pan, truss, or flat shaped heads by the Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y. This new self-locking screw is designed to facilitate faster, tighter, and more economical assembling of machine parts. An unusual feature of the screw is the patented ratchet-like teeth on the under side of the head, which eliminate the necessity for adding a lock-washer. Since the screw is made in one piece, it can readily be hopper fed. 125



Bay State "Saf-T-Cut" Cut-Off Wheels

"Saf-T-Cut" rough-sided cut-off wheels designed for cutting off or notching ferrous, non-ferrous, and non-metallic materials that are especially difficult to cut, including such work as cutting gates and risers on castings, slotting track welds, slicing transite, and cutting firebrick. This new abrasive wheel is constructed of special resinoid bonds reinforced with exceptionally strong nylon fibers. An added feature of the wheel is its side-cutting ability. Announced by the Bay State Abrasive Products Co., Westboro, Mass. 126

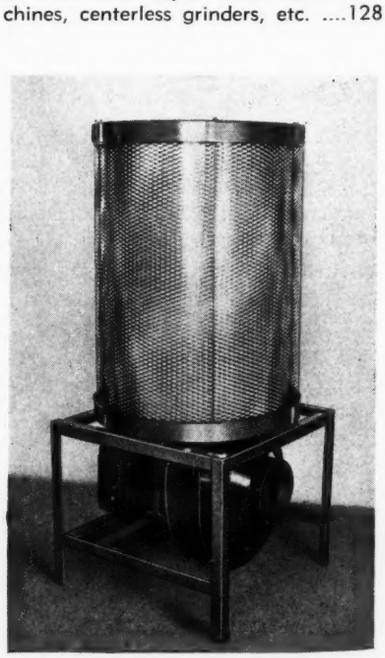


SpeedWay Drill

New "SpeedDrill" of 1/2-inch capacity recently announced by SpeedWay Mfg. Co., Cicero, Ill. This Type 400 drill weighs only 8 3/4 pounds, delivers a full 1/2 H.P. at the drill point under normal load. Aluminum die-castings are used throughout. The series-wound universal motor is designed for a high power to weight ratio. The cast-in air cooling system serves to cool the motor and clear away chips. Equipped with Jacobs geared chuck. 127

Vapor and Mist Collector

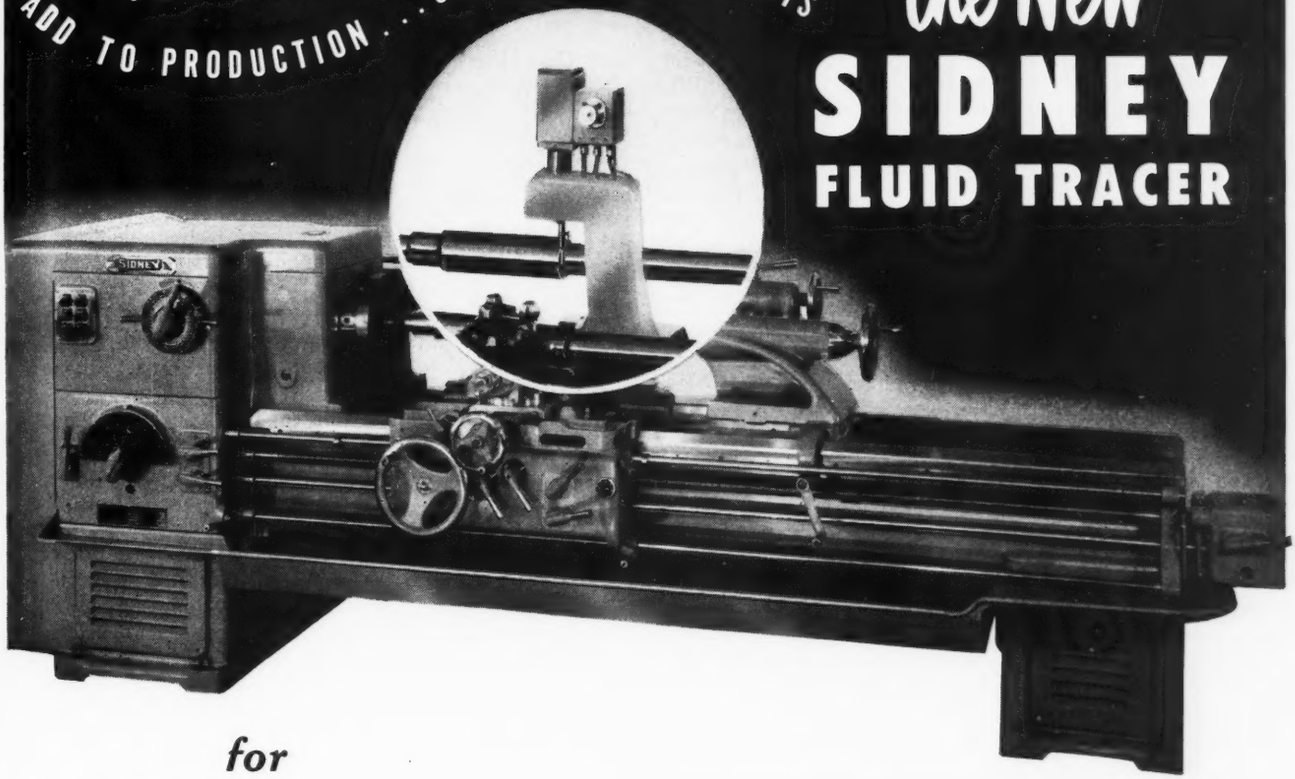
High-volume, self-contained vapor and mist collector designed to reduce fire hazards, which has been added to the line of unit type collectors made by the Aget-Detroit Co., Ann Arbor, Mich. This Model VC-5 collector develops 3600 cubic feet per minute capacity at 5 inches water lift through an 8-inch inlet when driven by its 5-H.P. motor. The unit is said to have ample capacity for collecting large volumes of mist and vapor from screw machines, centerless grinders, etc. 128



To obtain additional information on equipment described here, use Inquiry Card on page 217.

NOW... ADD TO PRODUCTION . . . SUBTRACT FROM COSTS

the New SIDNEY FLUID TRACER



for

- **increased production**
- **greater versatility**
- **wider range of work**
- **LOWER COSTS**

Here's an all-hydraulic controlled tracer with a DUAL PURPOSE . . . for tracing from round or flat template and regular lathe work with unlimited range for both.

Note how simple: just position one lever on clutch and brake unit to engage or disengage the tracer . . . that's all. No loss of time, no extra space, no parts to bother with, no extra expense for a single-purpose tool.

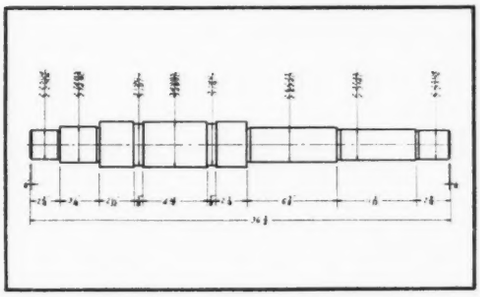
ABSOLUTELY SAME PRECISION ACCURACY AS WITH ALL SIDNEY PRODUCTS. Changes contour of the master piece are transmitted through the ultra-sensitive tracer valve as magically as if by an "electric eye" . . . even sharp shoulders are faced to amazingly close limits.

ADD the Sidney Fluid Tracer to any Sidney Model 32 Lathe. You'll enjoy the savings and efficiency of

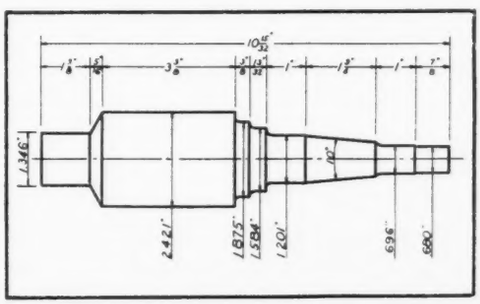
THE FINEST TURNING TOOL EVER PRODUCED

Please write for detailed literature or contact your nearest Sidney representative.

AMAZING SAVINGS THROUGH SIDNEY TURNING TIME



Normal Turning Time
4 hrs. 33 min.
SIDNEY TURNING TIME
38 min.
YOU SAVE
3 hrs. 55 min.



Normal Turning Time
25 min.
SIDNEY TURNING TIME
2 min. 31 sec.
YOU SAVE
22 min. 29 sec.

The SIDNEY MACHINE TOOL Company
Builders of Precision Machinery
SIDNEY ESTABLISHED 1904 OHIO

Boring D-Shaped Holes in Thin Work

By G. R. BALL

Some recent experimental work on airborne radar equipment necessitated the accurate positioning of cable feed-through connectors in pressurized bulkheads, the components being provided with flats to prevent them from rotating while the gland nuts are tightened. As the diversity of sizes and the thin section of the bulkheads made the use of broaches impracticable, the special boring head shown in the accompanying illustration was developed.

The head consists of a slotted lever *A*, pivoted in a forked body *B*, which is mounted directly in the machine spindle. A spring *S* holds the lever in its normal position against the adjustable stop *C*, the latter being used to locate the tool *T* while taking the cut. A hardened pad *D*, rigidly attached to the spindle head or quill, causes the point of the pin *H* to describe the chordal path, the length of which depends on the amount by which the pad overlaps the circular path described by the point of the pin. It will be evident that the tool *T* will reproduce the path of the pin *H*.

In practice, successive cuts are taken by adjusting stop *C* until the hole reaches the required size, pin *H* being so adjusted as to produce a longer flat than is required. When the correct diameter is reached, the stop is locked and pin *H* is gradually withdrawn, thereby shortening the flat until the required length is reached. Pin *H* is then permanently locked and subsequent holes of the same size can be bored.

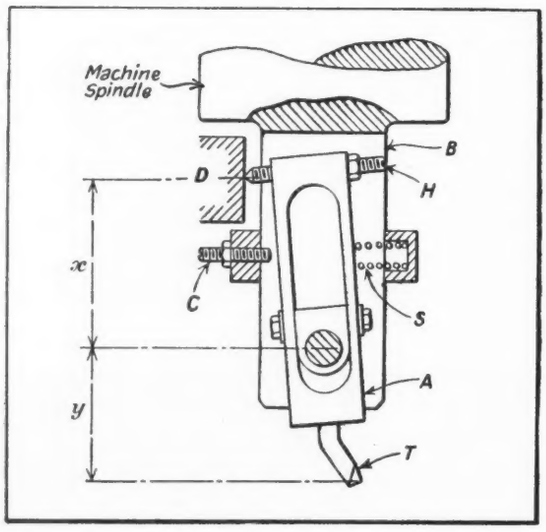
It will be apparent that the ratio between the lengths x and y must be the same as that between the diameter described by pin *H* and the diameter of the hole being bored. Provision for adjusting the lever *A* relative to its pivot, in order to maintain this relation, is made by the slotted construction of the lever. Stop *C* and spring *S* are mounted in a movable ring, and are always located as near as possible to the fixed pad *D*.

The boring head described has been successfully employed on holes ranging from 3/4 inch to 2 inches in diameter at speeds up to 300 R.P.M. without rebound, in spite of the fact that reliance must be placed upon the spring to provide cutting pressure.

* * *

Giant Press Requires Eleven Railroad Cars for Shipment

An 18,000-ton pipe forming press, the second of its type made by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, was recently shipped to the Orange, Tex., plant of the Consolidated Western Steel Corporation, in eleven railroad flat cars—the largest single shipment ever to leave the company's plant. This press will form 36-inch diameter pipe 40 1/2 feet long from 1/2-inch steel plate.



Special boring head designed to produce various size D-shaped holes in thin bulkheads

Grinding Pointers for Carbide Tools

Carbide tools can be ground as rapidly as high-speed steel tools, according to *Grits and Grinds*, published by the Norton Co., Worcester, Mass., if the following simple rules are observed:

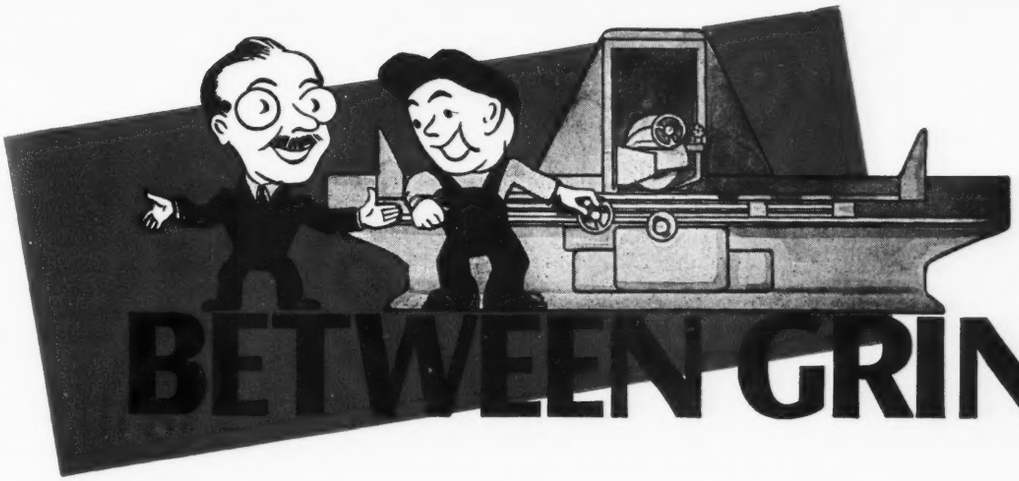
1. For rough-grinding single-point tools, use a silicon-carbide wheel sufficiently soft in grade to insure a fast, cool cutting action.
2. Dress the silicon-carbide wheel frequently with a star or Huntington type dresser; a roughly dressed wheel cuts faster and cooler. Crown the rim of cup type wheels about 1/16 inch to reduce the area of grinding contact.
3. Hold the tool with a relatively light pressure against the wheel. Keep the tool constantly in motion, moving it back and forth across the wheel face. Be sure to dress the wheel at the first signs of glazing or dulling. Should the tool become too hot to handle while grinding dry, lay it aside and work on another tool.
4. If grinding wet, use a sufficient flow of coolant to flood the tool. A dribble of coolant is worse than none at all and may crack the carbide tip as a result of alternate heating and quenching.

* * *

University of Iowa Offers Quality Control Course

An intensive ten-day course in quality control by statistical methods will be given at the State University of Iowa, on October 31 to November 10, inclusive. These statistical methods of quality control as developed by some of the nation's leading industries, with the cooperation of the Army and Navy and other governmental agencies, have shown remarkable results in aiding in the conversion from production of one type of product to another; improving quality of purchased materials; effecting economies in use of labor and materials; improving quality of final product; decreasing rejections and inspection costs; and improving producer-consumer relations.

Those interested can obtain additional details by writing to Professor Lloyd A. Knowler, Department of Mathematics, State University of Iowa, Iowa City, Iowa.



By E. S. Salichs

BETWEEN GRINDS

Epicurean Nails

Workmen admittedly preferred taste of old cut nails without lubricant or sawdust flavor to modern steel-wire nails. *Steelways* tells us that palatable nails heat-treated to a deep tasty blue are now being produced—just like grandpa's.

Sewing Up an Inquiry

The generality of our magazine's name often leads us to receive letters out of our field. So a lady from California urged us to send her the address of the manufacturer of the "Veto sewing machine," stating that if we did, "I shall be in your debt forever." When reference books failed us, we persevered gallantly with some telephone calls, and discovered it was the American Vitos Co. she had in mind.

Eating—Not Mechanically

While our Editor was on the Pacific Coast recently, he rubbed elbows with Max Stiles, sports writer for the "Los Angeles Mirror," who wrote in his column of July 5: "Newspapermen usually know where to get the best meal in any town they hit. The other night at Paul's Duck Press I was comparing notes with Charley Herb of New York City, editor of MACHINERY, and of all the places we have tried in the United States we agreed on the following six in our lists of ten: The Duck Press, Perino's and Cock 'n' Bull in Los Angeles, The Palm in New York, Antoine's in New Orleans and Lock-Ober's in Boston. Charley rounded out his tenth with the San Jacinto Inn of Houston, Miller's in Baltimore, Christ Cellas (for steaks) in New York, and the Bookbinders in Philadelphia. Not having tried those, my remaining four were La Louisiane in New Orleans, L'Aiglon in Chicago, Leone's in New York and Hoefly's at Belmont Shore."

The Tech that Grows in Brooklyn

"State Tech," the New York State Institute of Applied Arts and Sciences, is planning a wide variety of evening courses in the field of mechanical technology this fall over on Pearl St. in Brooklyn. Since prerequisites are not required for these Advancement-on-the-Job courses, it means that you needn't have completed 112.6 and its adjunct 112.7 plus twelve hours spent on a safari or six hours in a Turkish bath in order to register.

How the Twain Doesn't Meet

Chap on our staff received a telephone call that a mutual friend was hospitalized at the Rudyard Kipling Hospital in New York City, 42nd St. and Second Ave. He then dashed up to the hospital to offer comfort, but unfamiliar with its exact location, stopped to ask directions. Bewilderment shook the air until an agreement was reached that he was really headed for the Ruptured and Crippled Hospital.

MACHINERY breaks into Japanese occasionally. Here is a sample of one of Herbert Brown's articles on estimating costs which appeared in the Journal of the Japan Society of Mechanical Engineers. Fleetingly we thought the six-page article which had appeared in our September number had been condensed into these characters—until we recalled that in the correspondence involved, permission had been asked to abridge the article. What part of it was chosen for the Japanese journal is not easily identified without the aid of mirrors . . . . Well, we'll start by translating the title, How—, hmm, yes—"How to Estimate Milling Costs in the Job Shop."

〔82〕 フライス削り作業の時間算定

〔Herbert W. Brown, Machinery, Sept. 1949. p. 162~166, 表 6〕 横型フライス盤で削り作業をするときの時間算定法について論じてある．最初に切削の基礎となるすきま角に関して平フライス，エンドミル，正面フライス等で数値例と共に説明し続いて算定の基礎となる数表が掲げられその使用法が述べてある．

先ず被削材，カッタ種類，切削法の別による一般的な推奨速度表が掲げてあり，この表によると例えば 6 in 径 12 枚歯ハイス製正面フライスで軟鋳鉄を粗削りするときは，削り速度 60 ft/mn，送り 2·7 in/mn が得られる．

次に被削材別に削り速度と送り速度の数表を示して使用上の注意等について説明してある．

続いて時間算定のための表があげてある．送りを色々に変化し，削り長さを変化させたときに切削に要する時間の表がある．と共に時間算定のとき，一般に削り長さよりもフライス盤のテーブル移動量の方が大きいからこのオーバランを考えなければならないので，このために時間許容値としてカッタ径と切込深さに応じて削り長さに加える量が表にして示してある．

それからこれらの表によつて計算するとき時間の許容値として 20 % を加えることが必要とされており，実際の数値例によつて計算のやり方，数表の使い方を説明している．(By courtesy of The Machinery.)

〔小林 昭〕

News of the Industry

R. T. Adams, newly appointed sales manager for Hamilton-Kruse can-making machinery

Illinois

ROLAND H. JOHNSON has resigned as sales manager for the Hamilton-Kruse line of can-making machinery, according to an announcement by the Lima-Hamilton Corporation. He has joined the Standard Knapp Division of the Hartford Empire Co., manufacturer of packaging equipment. R. T. ADAMS succeeds Mr. Johnson as sales manager, with headquarters at 400 W. Madison St., Daily News Bldg., Chicago, Ill.

ILLINOIS TOOL WORKS, Chicago, Ill., announces the adoption of a new trade name for its line of prevailing torque type self-locking nuts. These nuts, formerly sold under the name "Tri-Lok," will be called "Lokuts" in the future. They are distributed by a division of the Illinois Tool Works—SHAKEPROOF INC., 2501 N. Keeler Ave., Chicago 39, Ill. "Lokuts" are manufactured under exclusive license from the BOOTS AIRCRAFT NUT CORPORATION, Stamford, Conn.

CARL VOORHIES has been made chief engineer of the Valve Tappet Division of the Chicago Screw Co., Bellwood, Ill. For the last two years, Mr. Voorhies has been consultant to various automotive manufacturers, and he has spent sixteen years in specialized valve gear work. He is the author of a number of articles and technical papers on valve tappets and valve gears.

PHILIP JOHNSTON has been appointed sales manager of the Riehle Testing Machines Division of American Machine & Metals, East Moline, Ill., succeeding T. L. RICHARDS.

A. J. GRINDLE has been appointed consulting metallurgical engineer of the Whiting Corporation, Harvey, Ill., succeeding the late A. W. Gregg.

Maryland

ALEXANDER MILBURN, INC., 1231-1245 Ridgely St., Baltimore, Md., has been incorporated to manufacture and market the Milburn line of oxy-acetylene cutting and welding apparatus and accessories. The Milburn line has been on the market since 1907, and has been marketed since 1945 by the BLACK MFG. Co., Parkton, Md.

R. M. BROWN, formerly sales engineer with the Bristol Co. of Canada, Ltd., and more recently instrumentation engineer with Stadler Hurter & Co., Montreal, has rejoined the Bristol Co.'s sales organization, and will be stationed at Baltimore, Md.

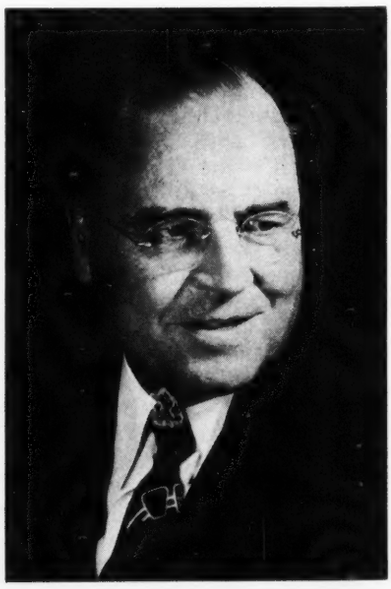
Michigan

KENNETH R. BEARDSLEE, formerly vice-president and marketing manager of Carboloy Company, Inc., Detroit, Mich., has been named president of the company, succeeding the late Walter G. Robbins. EUGENE F. WAMBOLD, vice-president in charge of manufacturing, has been appointed to the newly created post of executive vice-president in charge of manufacturing, engineering, employe and community relations, and purchasing. Both men have also been named to the board of directors.

MICHIGAN TOOL CO. announces the sale of the TUNGSTEN CARBIDE TOOL CO., Detroit, Mich., to A. E. TOZER, who has been general manager of the latter company since it was founded. The business will be continued under the same name. A new plant is being constructed at 26250 W. Seven Mile Road, Detroit, Mich., which is expected to be ready for occupancy about September 15. While the Michigan Tool Co. is discontinuing the manufacture of general-purpose carbide tools, it will continue to produce, in addition to its line of high-speed steel tools, carbide-tipped tools used for gear production purposes.

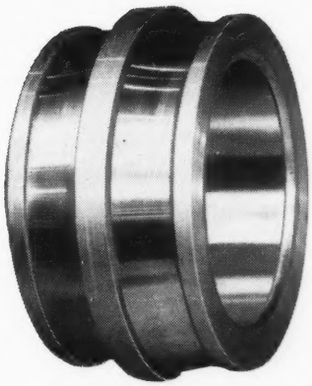
C. B. DEKORNE, 652 Turner Ave., N. W., Grand Rapids 4, Mich., has been appointed sales representative in western Michigan for the Lovejoy Tool Co., Inc., Springfield, Vt., manufacturer of milling cutters, boring heads, counterbores, etc.

ACE DRILL CORPORATION, manufacturer of ground-from-the-solid drills and special tools, has moved its plant and offices from Detroit to 2600 E. Maumee Ave., Adrian, Mich. The new plant more than doubles the previous manufacturing area.



Kenneth R. Beardslee, new president of Carboloy Company, Inc., and (right) Eugene F. Wambold who has been appointed executive vice-president of the company

SKF RACES Against Time...



with the new

GISHOLT NO. 24 HYDRAULIC AUTOMATIC LATHE

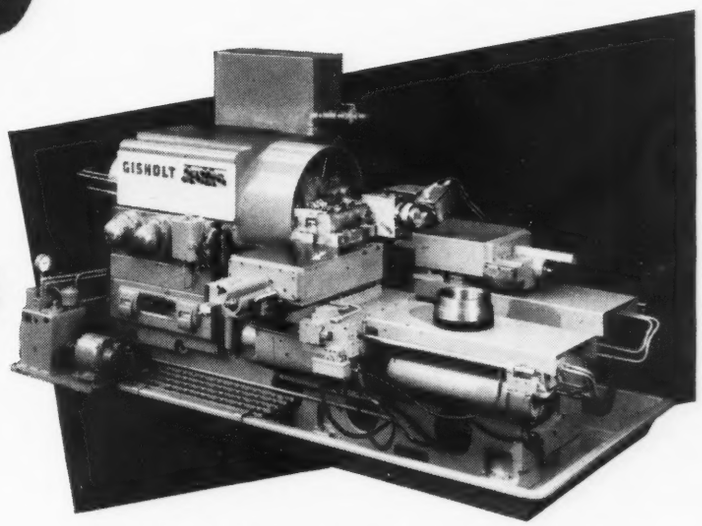
When it comes to fast production of top quality spherical roller bearing races, SKF doesn't fool.

These new Gisholt No. 24 Hydraulics remove 34 lbs. of metal in two operations in a total of only 2.80 minutes' machining time on each of two machines. All cutting is on 52100 bearing steel and done at speeds of 325 to 350 f.p.m.

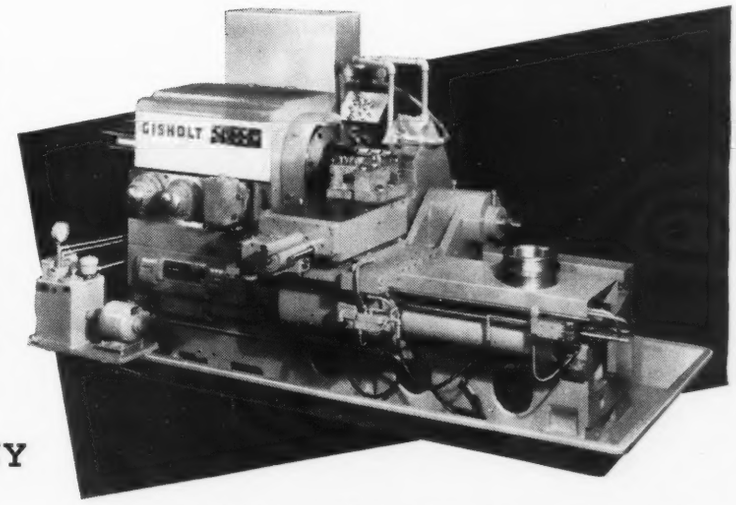
Speed is important, of course. But precision is the governing factor. How the Gisholt No. 24 does the job is a story that might mean real savings for you, too.

The No. 24 Hydraulic Automatic Lathe is a larger version of the famous No. 12 that has an outstanding success record on hundreds of jobs. If you have large volume precision work up to 24″ diameter, the Gisholt No. 24 is the machine to investigate. Write for full information.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

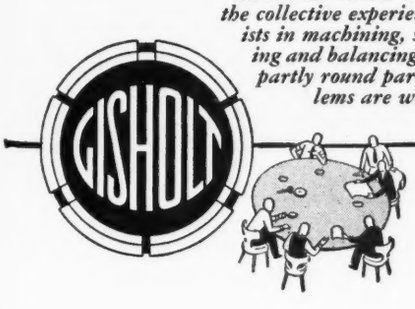


First Operation: Chucked on OD with 3-jaw hydraulic chuck, part is turned up to the jaws, faced, chamfered, bored and bore radius formed. Cam relief on rear tool block turns boring bit clear of workpiece as it is withdrawn.

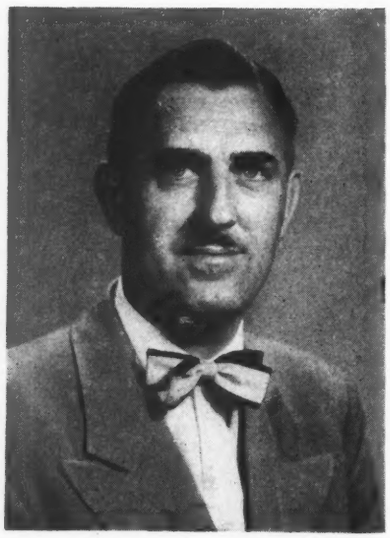


Second Operation: Part held on expanding arbor by hydraulic pressure is finish turned, faced, chamfered and bore radius formed. Special rocker arm type carriage at rear tips in shaving tools to form both roller grooves with feed of .003″ to .0045.″

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*



TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



George Eldred, newly appointed abrasive sales manager of the Micromatic Hone Corporation

GEORGE ELDRED has been appointed abrasive sales manager of the Micromatic Hone Corporation, Detroit, Mich. Mr. Eldred, who has been with the company for thirteen years, was formerly manager of the eastern sales territory.

N. G. SIXT has been named technical assistant to FRED P. HAUCK, vice-president of the Michigan Abrasive Co., Detroit, Mich.

CARBOLOY COMPANY, INC., Detroit, Mich., announces the appointment of J. E. WELDY as marketing manager, J. S. GILLESPIE as product sales manager, and J. M. BERTOTTI as field sales manager.

STANDARD TOOL CO., Cleveland, Ohio, announces that the Detroit office of the company has been moved to 2967 E. Grand Boulevard.

New England

SPRAGUE ELECTRIC CO., North Adams, Mass., and PHILIPS INDUSTRIES, INC., Hartford, Conn., have announced the formation of a new corporation to be known as the FERROXCUBE CORPORATION OF AMERICA, with headquarters at 50 E. 41st St., New York City. The corporation will manufacture "Ferroxcube," a new ferro-magnetic ferrite for use as a core material in high-frequency coils and transformers. ROBERT C. SPRAGUE has been appointed president, JOHN P. ADAMS, vice-president in charge of sales, and T. JAMES REED, manager of the factory at Saugerties, N. Y.

THORN L. MAYES has been appointed manager of the Lynn Motor Engineering Division of the Small and Medium Motor Divisions of the General Electric Co., Lynn, Mass. Another recent appointment is that of JOHN J. MILLER who has been made manager of the Industrial Division of the General Electric Co.'s Apparatus Department, Mid-States District, with headquarters at St. Louis, Mo.

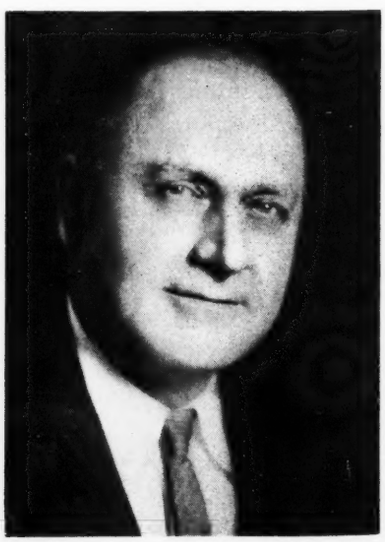
EVERETT M. HICKS has been appointed manager of the Grinding Machine Division of the Norton Co., Worcester, Mass., and WALTER G. JOHNSON has been named manager of research and engineering of the division. Mr. Hicks, who has been assistant manager of the division since 1947, is assuming the managerial duties of FRANK W. SMITH, who is devoting his full time to policy-making duties as vice-president in charge of the Grinding Machine Division. Mr. Johnson was assistant chief engineer at the time of his appointment, and succeeds ALBERT G. BELDEN, who has retired after thirty-eight years of service with the company. IRWIN W. PETERSON has been appointed salesman in the Detroit area.

JOHN B. POWELL has been made manager of the Engineering Division of the New England district of General Electric Co.'s Apparatus Department, succeeding GEORGE H. JUMP, who has been appointed engineering consultant for the district. Mr. Powell will be located at the company's New England headquarters, 140 Federal St., Boston, Mass.

HY-PRO TOOL CO., New Bedford, Mass., manufacturer of taps, slotting saws, and allied metal-cutting tools, is now established in its new plant, which is double the size of its former quarters. The new factory is located next to the Continental Screw Co., of which it is a subsidiary.

WILLARD R. BARRETT has been made sales manager for the Plastics Division of the General Electric Co., Pittsfield, Mass. Mr. Barrett was formerly vice-president and general manager of the Hoosier Cardinal Corporation, Evansville, Ind., maker of decorative metals and plastics.

NEVEROIL BEARING CO., Wakefield, Mass., has changed its name to the WAKEFIELD BEARING CORPORATION due to the fact that the company now manufactures a variety of types of bearings, in addition to its original line of oilless bearings.



(Left to Right) Everett M. Hicks, recently appointed manager of the Grinding Machine Division of the Norton Co.; Walter G. Johnson, manager of research and engineering of the Grinding Machine Division; Albert G. Belden, who has retired as manager of research and engineering after thirty-eight years with the Norton Co.

Quality control checking of connecting rods on Sheffield Precisionaires at one of our leading automotive plants.

ONLY THE BEST GAGES ARE GOOD ENOUGH FOR QUALITY CONTROL!

Control charts compare measurements of present product with those of the past. Only the very best gages are good enough to have measured the past—only the very best are good enough for the present. Without truly accurate measurements then and now, quality control is but a myth.

Defects are prevented before they are made when machine operators are provided with the best indicating gages to show them "where they are going." This is just as true in Receiving and Final Inspection—and for spot check and full lot inspections.

You'll find "It's Wise and Thrifty to Specify Sheffield" gages and measuring instruments for your quality control inspection. Because of its world-wide experience, Sheffield has been accepted as headquarters for single and multiple dimension, semi and fully automatic gaging equipment. This wealth of experience is yours to draw upon—no obligation.

Write for catalogs.

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Amplifications from 500 to 10,000 to 1 • Infinite variety of anvils, accessories and thread checking equipment • Most durable and trouble-free comparator ever made.

FAMOUS COLUMN PRECISIONAIRES

1M; 2M; 5M; 10M; 20M, and 40M amplifications • 1; 2, 3, 4, or 5 columns • Greatest linear scale range • An unsurpassed experience in developing internal and external air gaging equipment.

STURDY DIAL SNAP

This is the workhorse of dial indicator snap gages • Available in 12 models covering 1" to 12" range • Each adjustable for one inch • Used manually or in a stand.

DEAD-STOP DIAL PRECISIONAIRE

Built to "take it" • Ruggedly withstands abuse • Indicates "on the nose" • Lightning-quick dead-stop indicator action • Advanced type adjustable dial with accurate even-spaced linear scale.

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the *Sheffield* corporation

Dayton 1, Ohio, U. S. A.

GAGES • MEASURING INSTRUMENTS • MACHINE TOOLS • CONTRACT SERVICES • THREADING TOOLS

Charles H. Gallaway, new president of the Industrial Safety Equipment Association

CHARLES H. GALLAWAY, sales manager of the Safety Products Division of the American Optical Co., Southbridge, Mass., was elected president of the Industrial Safety Equipment Association at the annual meeting of the Association, held in White Sulphur Springs in June.

ALBERT L. GUTTERSON has been elected president of the Lovejoy Tool Co., Inc.. Springfield, Vt., succeeding Charles N. Safford, who died in July. Mr. Gutterson has been associated with several New England companies, including the Fellows Gear Shaper Co., the Jones & Lamson Machine Co., and Gilbert & Barker Mfg. Co., in engineering and sales capacities. For the last few years, he has acted as manufacturers' agent in Vermont and New Hampshire for concerns manufacturing equipment used by the petroleum industry. GEORGE A. PERRY has been elected to fill Mr. Safford's place as director.

CONE AUTOMATIC MACHINE CO., INC., Windsor, Vt., at a recent meeting of the board of directors, elected the following officers: H. P. MCCLARY, chairman of the board; H. P. CHAPLIN, president and treasurer; J. A. GERARD, vice-president in charge of sales; L. L. CONE, vice-president; and A. B. MCCLARY, secretary.

LEONARD J. MAGUIRE has been made works manager of the scale plant of Fairbanks, Morse & Co. in St. Johnsbury, Vt. He was previously chief engineer.

REMINGTON ARMS CO., INC., Bridgeport, Conn., and CRUCIBLE STEEL CO. OF AMERICA, New York, N. Y., have announced plans for the formation of a new jointly owned company for the production of titanium metal and titanium-metal alloy products. These products will include sheets, rods, tubes, wire, forgings, castings, and other fabricated forms for industrial use. At present, sales of titanium will be handled from the offices of the Remington Arms Co., Inc., but it is contemplated that all operations will later be moved to Pittsburgh, Pa.

READY TOOL CO., Bridgeport, Conn., announces the appointment of the following sales engineers: BRANT & COCHRAN, Grand River Ave., Detroit 26, Mich., and DEPENDABLE ENGINEERING SERVICE, INC., with offices at 4407 W. North Ave., Milwaukee 8, Wis., and 9 S. Clinton St., Chicago 6, Ill.

New Jersey

WILLIAM F. HOFFMAN has announced the purchase of the NEWARK GEAR CUTTING MACHINE CO., 69 Prospect St., Newark, N. J., and the change of its name to NEWARK GEAR, INC. Mr. Hoffman is president of the reorganized company. LEONARD M. SMITH is vice-president in charge of sales, and HENRY M. EBERHARDT vice-president in charge of engineering.

H. R. GIBBONS has been appointed chief engineer of the Hyatt Bearings Division of General Motors Corporation, Harrison, N. J. Mr. Gibbons, who has been assistant chief engineer for the last seven years, succeeds O. W. YOUNG, now technical assistant to the office of the general manager.

WILLIAM J. MILLETT, assistant to the vice-president in charge of manufacturing of the Worthington Pump & Machinery Corporation, Harrison, N. J., has been appointed works manager of the Holyoke Works, replacing E. M. DETWILER, who has resigned.

JESSE W. EAKINS has been appointed eastern Michigan and Toledo, Ohio, metropolitan area sales representative of the Centric Clutch Co., 22-26 South Ave., West, Cranford, N. J., manufacturer of Rawson centrifugal clutch couplings.

New York

THOMAS J. WOOD has been appointed chief metallurgist of the Brake Shoe and Castings Division of the American Brake Shoe Co., 230 Park Ave., New York 17, N. Y. RAYMOND A. FRICK becomes eastern district works manager, the post formerly held by Mr. Wood. RALPH C. WHITE has been made superintendent of the North Kansas City plant, and RAYMOND A. MARTINSON superintendent of the Chicago plant.

BUFFALO BOLT CO., Buffalo, N. Y., has announced a merger of its affiliates—S. M. JONES Co., Toledo, Ohio; ECLIPSE LAWN MOWER Co., Prophetstown, Ill.; and PENBERTHY INJECTOR Co., Detroit, Mich.—into the company, operating as divisions, but retaining their corporate titles. Also, the name of the company has been changed to BUFFALO-ECLIPSE CORPORATION. R. B. FLERSHEM, president of the Buffalo Bolt Co., will be president of the new corporation.

CHARLES C. LEADER has been appointed staff assistant to E. E. JOHNSON, manager of engineering of the Large Apparatus Divisions, General Electric Co., Schenectady, N. Y. Mr. Leader has been associated with the company since 1929, and was assistant to the manager of Manufacturing of the Control Divisions at the time of his appointment.

ELBRIDGE G. DUDLEY and LOUIS F. RODEWIG have been appointed manager and assistant manager, respectively, of the Industrial Division of the General Electric Apparatus Department's New York district.

HAMILTON MERRILL, vice-president and director of Manning, Maxwell & Moore, Inc., Chrysler Bldg., New York City, has been elected president of the company, succeeding the late Robert Ross Wason.

GORDON F. SEELY, who has been working in the Detroit area for the Chicago Pneumatic Tool Co., New York City, has been appointed field engineer of the Chicago Pneumatic Hydraulic Tool Division.

Ohio

LEE O. WITZENBURG has been made general sales manager of the Cleveland Worm & Gear Co., Cleveland,

Lee O. Witzenburg, general sales manager of Cleveland Worm & Gear Co.

AMOUNT OF DRAFT FOR VARIOUS DRAFT ANGLES AND CAVITY DEPTHS—3

Draft Angle, Degrees	Amount of Draft, Inch — Cavity Depth, Inch															
	17/32	9/16	19/32	5/8	21/32	11/16	23/32	3/4	25/32	13/16	27/32	7/8	29/32	15/16	31/32	1
1/2	0.0046	0.0049	0.0052	0.0055	0.0057	0.006	0.0063	0.0065	0.0068	0.0071	0.0074	0.0076	0.0079	0.0082	0.0085	0.0087
1	0.009	0.0099	0.010	0.011	0.011	0.012	0.013	0.013	0.014	0.014	0.015	0.015	0.016	0.017	0.017	0.0175
2	0.019	0.020	0.021	0.022	0.023	0.024	0.025	0.027	0.028	0.029	0.030	0.031	0.032	0.033	0.034	0.035
3	0.028	0.030	0.031	0.033	0.035	0.036	0.038	0.039	0.040	0.043	0.045	0.046	0.048	0.050	0.051	0.052
4	0.037	0.039	0.042	0.044	0.046	0.048	0.050	0.053	0.055	0.057	0.059	0.061	0.063	0.066	0.068	0.070
5	0.046	0.049	0.052	0.055	0.057	0.060	0.063	0.066	0.068	0.071	0.074	0.077	0.079	0.082	0.084	0.087
6	0.056	0.059	0.062	0.066	0.069	0.072	0.075	0.079	0.081	0.085	0.089	0.092	0.095	0.098	0.101	0.105
7	0.065	0.069	0.073	0.077	0.082	0.085	0.088	0.092	0.096	0.100	0.104	0.107	0.111	0.115	0.119	0.123
8	0.075	0.079	0.084	0.088	0.092	0.096	0.101	0.106	0.110	0.115	0.119	0.123	0.128	0.132	0.137	0.141
9	0.084	0.088	0.094	0.100	0.104	0.109	0.114	0.119	0.124	0.129	0.134	0.139	0.144	0.149	0.153	0.158
10	0.093	0.099	0.105	0.110	0.115	0.121	0.126	0.132	0.137	0.143	0.149	0.154	0.159	0.165	0.170	0.176
11	0.103	0.109	0.115	0.120	0.127	0.133	0.139	0.146	0.152	0.158	0.163	0.171	0.176	0.182	0.188	0.194
12	0.113	0.120	0.127	0.133	0.140	0.147	0.153	0.159	0.166	0.173	0.180	0.186	0.193	0.200	0.206	0.213
15	0.142	0.151	0.159	0.167	0.176	0.183	0.193	0.201	0.209	0.218	0.226	0.234	0.243	0.251	0.260	0.268
20	0.193	0.205	0.216	0.227	0.239	0.250	0.261	0.273	0.284	0.296	0.307	0.318	0.329	0.341	0.353	0.364
25	0.247	0.262	0.277	0.291	0.306	0.321	0.335	0.350	0.364	0.379	0.393	0.408	0.422	0.437	0.452	0.466
30	0.306	0.325	0.343	0.361	0.379	0.397	0.415	0.433	0.451	0.469	0.487	0.505	0.523	0.541	0.559	0.577

MACHINERY'S Data Sheet No. 665, September, 1950

Compiled by the Detroit Mold Engineering Co., Detroit, Mich.

STANDARD DIMENSIONS FOR WELDED AND SEAMLESS STAINLESS-STEEL PIPE

Sponsored by the American Society for Testing Materials and American Society of Mechanical Engineers
Approved by American Standards Association as Standard B36.19—1949

Nominal Pipe Size, Inches	Outside Diameter, Inches	Nominal Wall Thickness, Inches			Weight of Steel Pipe (Plain Ends) Pounds per Linear Foot		
		Schedule 10 S	Schedule 40 S	Schedule 80 S	Schedule 10 S	Schedule 40 S	Schedule 80 S
1/8	0.405	0.049	0.068	0.095	0.19	0.24	0.31
1/4	0.540	0.065	0.088	0.119	0.33	0.42	0.54
3/8	0.675	0.065	0.091	0.126	0.42	0.57	0.74
1/2	0.840	0.083	0.109	0.147	0.67	0.85	1.09
3/4	1.050	0.083	0.113	0.154	0.86	1.13	1.47
1	1.315	0.109	0.133	0.179	1.40	1.68	2.17
1 1/4	1.660	0.109	0.140	0.191	1.81	2.27	3.00
1 1/2	1.900	0.109	0.145	0.200	2.09	2.72	3.63
2	2.375	0.109	0.154	0.218	2.64	3.65	5.02
2 1/2	2.875	0.120	0.203	0.276	3.53	5.79	7.66
3	3.500	0.120	0.216	0.300	4.33	7.58	10.25
3 1/2	4.000	0.120	0.226	0.318	4.97	9.11	12.51
4	4.500	0.120	0.237	0.337	5.61	10.79	14.98
5	5.563	0.134	0.258	0.375	7.77	14.62	20.78
6	6.625	0.134	0.280	0.432	9.29	18.97	28.57
8	8.625	0.148	0.322	0.500	13.40	28.55	43.39
10	10.750	0.165	0.365	0.500	18.70	40.48	54.74
12	12.750	0.180	0.375	0.500	24.20	49.56	65.42

Notes: Dimensional standards are based on materials covered by A.S.T.M. Specifications A-158 and A-312. Actual wall thickness shall not be more than 12.5 per cent under the nominal wall thickness shown. Permissible variations in other dimensions are indicated in the A.S.T.M. specifications. Weights are calculated on the basis of the specific density of carbon steel (0.2833 pound per cubic inch), and different grades of stainless steel may weigh more or less. The schedule numbers indicate the approximate values of the expression: 1000 × P/S, where P/S is the pressure-stress ratio.

MACHINERY'S Data Sheet No. 666, September, 1950

LET

EX-CELL-O

PRODUCE YOUR
PRECISION PARTS
AND SUB-ASSEMBLIES

Having trouble holding close tolerances on production parts? Are precision sub-assemblies a bottleneck? Ex-Cell-O has the know-how that will lick these problems and keep parts or sub-assemblies flowing to your plant in just the quantities you need. Ex-Cell-O has very complete parts production facilities, and being one of the largest precision machine tool manufacturers, can work out the most practical processing with both standard and special production equipment. Call your local Ex-Cell-O representative, or send a part print to Ex-Cell-O in Detroit for a quotation.

EX-CELL-O CORPORATION

DETROIT 32
MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS
DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

50-3

Ohio, and its subsidiary, the Farval Corporation. Mr. Witzenburg was previously sales manager of the Tann Corporation, Detroit, Mich.

HARRY O. JOHNSON, general superintendent of central furnaces and docks and of the coke works of the American Steel & Wire Co., Cleveland, Ohio, has been transferred to company headquarters in the Rockefeller Bldg., Cleveland, where he will perform special duties in the office of the vice-president, operations. Succeeding him as general superintendent of the two plants is JOHN E. ALLEN. GEORGE MARCH has been advanced to the position of works superintendent of central furnaces and docks.

MONARCH MACHINE TOOL CO., Sidney, Ohio, announces plans for adding to the company's plant and equipment. The expansion program, which will cost approximately half a million dollars, involves replacing about 30,000 square feet of the old plant and constructing 12,000 additional square feet, which will permit rearranging and improving the present manufacturing lay-out.

BEAMAN H. AYERS has been appointed vice-president and works manager of the National Acme Co., Cleveland, Ohio, succeeding R. C. KINLEY, who has announced his retirement from active duty after forty-seven years of service with the company. Mr. Kinley will continue to serve in a consulting capacity. Mr. Ayers has been with the company since 1915, when he joined the Windsor, Vt., division as a toolmaker. At the time of his appointment to the vice-presidency, Mr. Ayers was general superintendent, and the position he vacated will be filled by JOHN L. MOLNER, previously manager of the No. 2 plant Contract Manufacturing Division.

A. W. SAWYER was recently appointed assistant to the vice-president of the Lincoln Electric Co., Cleveland, Ohio. Prior to his appointment, he was in charge of development and production of welding instruction aids. In his present position, Mr. Sawyer will handle government bids and contracts and will also conduct the educational activities of the company.

HOMER E. RIEKER has been appointed manager of the tubular products department in the Cleveland plant of Joseph T. Ryerson & Son, Inc. He succeeds ALLEN P. BECKLOFF, who has been promoted to the position of divisional manager of tubular products, with headquarters at Chicago.

NORMAN F. SMITH has been appointed plant superintendent of the DeVilbiss Co., Toledo, Ohio, manufacturer of spray finishing equipment, air compressors, and atomizers. For the last three years, he has been chief process engineer with the Pyle National Co., of Chicago, Ill.

ALFRED D. JENNS has been made district manager of the Cincinnati office of Ampco Metal, Inc., Milwaukee, Wis. He has been affiliated with the company for over nine years, and prior to his present appointment was field engineer at Milwaukee.

ROBERT E. LABONDE has been appointed advertising and export manager of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, succeeding B. N. BROCKMAN, JR., who has joined the Oliver H. Van Horn Co., Houston, Tex., as sales manager.

FRANK W. LEITNER has been appointed a sales engineer for the Reliance Electric & Engineering Co., Cleveland, Ohio. His territory will cover North and South Carolina, and his headquarters will be at Charlotte, N. C.

Pennsylvania

E. A. DEZUBAY, research engineer, and G. W. HARDIGG, design engineer with the Westinghouse Electric Corporation, Pittsburgh, Pa., recently received Benjamin Garver Lamme scholarships, valued at $2500 each, which can be applied toward full time graduate study at an accredited university either in this country or abroad. These scholarships are awarded to recognize marked ability and to further the development of young engineers and scientists who have demonstrated a capacity to do creative work of a high order.

FRANK B. RACKLEY, formerly executive vice-president of the Jessop Steel Co., Washington, Pa., was elected president of the company at a recent meeting of the directors. Mr. Rackley joined the company in June, 1948, as general manager of sales. He was made vice-president in charge of sales in October, 1948, and became executive vice-president in May, 1949.

WILLIAM J. MCKEE, formerly sales manager of the central area for the National Tube Co., Pittsburgh, Pa., has been made general manager of sales of the company. LOUIS W. MASON, who previously held the posi-

(Left to Right) Beaman H. Ayers, newly appointed vice-president and works manager of the National Acme Co.; R. C. Kinley, who has retired as vice-president and works manager after forty-seven years with the company; and John L. Molner, new general superintendent

tion of assistant to the general manager of sales, succeeds Mr. McKee as sales manager in the central area. The company has also announced the election of WILLIAM F. MCCONNOR as executive vice-president, and of H. J. WALLACE as vice-president in charge of sales.

R. G. Tabors, manager of hydraulic press and power tool department of Baldwin Locomotive Works

R. G. TABORS has become manager of the hydraulic press and power tool department of the Baldwin Locomotive Works, Eddystone, Pa. Mr. Tabors was previously sales manager of the department.

GEORGE H. MCBRIDE has been made manager of the Gearing Division of the Westinghouse Electric Corporation, Pittsburgh, Pa., succeeding

George H. McBride, recently appointed manager of the Gearing Division of the Westinghouse Electric Corporation

LOUIS R. BOTSAI, whose appointment as manager of the Westinghouse Buffalo plant was mentioned in August MACHINERY. Mr. McBride has been manager of sales of the Gearing Division since 1942.

WM. K. STAMETS CO., Pittsburgh, Pa., announces the purchase of the ENTERPRISE CO., Columbiana, Ohio, machinery manufacturer. The Stamets company, which is primarily a machine tool distributing concern, also designs and builds special pipe machinery. The Enterprise Co. has been acquired by the company for use as a manufacturing plant, but will also continue to be operated as a contract shop. JOHN BACKSTROM will be the new works manager of the Enterprise Division.

KENNAMETAL, INC., Latrobe, Pa., announces the following appointments: FLOYD MONTEITH, representative at the Chicago office; ROBERT KARAKOOSH, representative at the Springfield office; WILLIAM COLLINS and HAROLD D. KILLMER, service engineers, with headquarters at Springfield; and CONRAD SEIM, service engineer, with headquarters at Los Angeles.

INTERSTATE MACHINERY CO., INC., Chicago, Ill., announces the opening of an Eastern Division office at 2829 N. Broad St., Philadelphia, Pa. FRANK J. LUNNEY will be Eastern Division manager.

LOUIS DEMARCO has been appointed sales engineer with the Carbide Division of the Firth Sterling Steel & Carbide Corporation, McKeesport, Pa.

Washington

DAVID R. MESLANG has been appointed manager of the Seattle, Wash., branch of the Crucible Steel Co. of America, New York City. He has been connected with the company since 1935, when he joined the San Francisco branch. Previous to serving in the Army in the last war, he was office manager of the Seattle branch. Upon his return to the company in October, 1946, he became a salesman at San Francisco.

* * *

Lincoln Announces New Welding Cable

A new type of welding cable for both electrode and ground, known as "Linconductor" cable, is now available through the Lincoln Electric Co., Cleveland 1, Ohio. The outer cover of the cable is Neoprene with a paper separator of 2 1/2 mil thickness between it and the copper stranding, providing long life and maximum flexibility.

Coming Events

SEPTEMBER 13-18 — Twenty-seventh annual convention of the NATIONAL ASSOCIATION OF FOREMEN at the Hotel Statler in Buffalo, N. Y. Further information can be obtained by addressing the Association at its headquarters, 321 W. First St., Dayton 2, Ohio.

SEPTEMBER 18-22—FIFTH NATIONAL INSTRUMENT EXHIBIT of the INSTRUMENT SOCIETY OF AMERICA in the Memorial Auditorium, Buffalo, N. Y. Further information can be obtained from the Society at 921 Ridge Ave., Pittsburgh 12, Pa.

SEPTEMBER 19-21—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Worcester, Mass.; headquarters, Hotel Sheraton. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 25-27 — Sixth annual NATIONAL ELECTRONICS CONFERENCE EXHIBITION at the Edgewater Beach Hotel, Chicago, Ill. Chairman of exhibit committee, Kipling Adams, 920 S. Michigan Ave., Chicago 5, Ill.

SEPTEMBER 26-29—IRON AND STEEL EXPOSITION, in conjunction with the annual convention of the ASSOCIATION OF IRON AND STEEL ENGINEERS, at the Cleveland Public Auditorium, Cleveland, Ohio. For further information, address the Association, 1010 Empire Bldg., Pittsburgh 22, Pa.

SEPTEMBER 27-29—Annual convention of the NATIONAL METAL TRADES ASSOCIATION at the Hotel Commodore in New York City. Secretary, Charles L. Blatchford, 122 S. Michigan Ave., Chicago 3, Ill.

OCTOBER 16-20—Thirty-eighth NATIONAL SAFETY CONGRESS and EXPOSITION in Chicago, Ill. R. L. Forney, general secretary, National Safety Council, 425 N. Michigan Ave., Chicago, Ill.

OCTOBER 18-20 — Annual national conference of the SOCIETY OF THE PLASTICS INDUSTRY at New Ocean House, Swampscott, Mass. Further information can be obtained from William T. Cruse, executive vice-president, 295 Madison Ave., New York 17, N. Y.

OCTOBER 23-25—Fall meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Edgewater Beach Hotel, Chicago, Ill. Executive secretary, Newbold C. Goin, Empire Bldg., Pittsburgh 22, Pa.

OCTOBER 23-27—Fall meeting of the Metals Branch of the AMERICAN INSTITUTE OF MINING AND METALLUR-

(Continued on page 240)

CECOSTAMP MODEL "L"

30" x 24" CECOSTAMP showing special notch for keying dies in ram and anvil bolster plate. Equipped with special foot treadle

(At right) 66" x 60" Four-Column CECOSTAMP

FOR JOB STAMPING

10% more powerful than preceding CECOSTAMPS
Handles a wider range of work
Easier to operate
More Accurate
Safer

For Further Details Write for Bulletin 30-L-0

CHAMBERSBURG ENGINEERING COMPANY

CHAMBERSBURG · PENNSYLVANIA

GICAL ENGINEERS in Chicago, Ill. National secretary, E. H. Robie, 29 W. 39th St., New York 18, N. Y.

OCTOBER 23-27—Annual meeting of the AMERICAN SOCIETY FOR METALS in Chicago, Ill. National secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 23-27—Annual meeting of the AMERICAN WELDING SOCIETY in Chicago, Ill. National secretary, J. G. Magrath, 33 W. 39th St., New York 18, N. Y.

OCTOBER 23-27—Annual meeting of the SOCIETY FOR NON-DESTRUCTIVE TESTING in Chicago, Ill. National secretary, Philip D. Johnson, Skokie, Ill.

OCTOBER 23-27 — NATIONAL METAL CONGRESS and EXPOSITION at the International Amphitheater, Chicago, Ill. For further information, address W. H. Eisenman, managing director, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

NOVEMBER 2-3—Fourteenth annual NATIONAL TIME, MOTION, AND MANAGEMENT CLINIC at the Sheraton Hotel, 505 N. Michigan Ave., Chicago, Ill. Sponsored by the Research Division of the Industrial Management Society, 35 E. Wacker Drive, Chicago 1, Ill.

NOVEMBER 2-3—Annual conference on principles, methods, and techniques for increasing productivity, reducing costs, and improving human relations, sponsored by the SOCIETY FOR ADVANCEMENT OF MANAGEMENT at the Hotel Statler, New York City. For further information, address the Society, 84 William St., New York 7, N. Y.

NOVEMBER 27-DECEMBER 2 — NINETEENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace, New York 17, N. Y., in conjunction with the annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary of A.S.M.E., Clarence E. Davies, 29 W. 39th St., New York 18.

JANUARY 15-18, 1951—SECOND PLANT MAINTENANCE SHOW AND CONFERENCE at the Auditorium, Cleveland, Ohio. For further information, address Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MARCH 19-23, 1951—WESTERN METAL CONGRESS AND EXPOSITION at the Civic Auditorium, Oakland, Calif. Sponsored by the American Society for Metals. National secretary, William H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

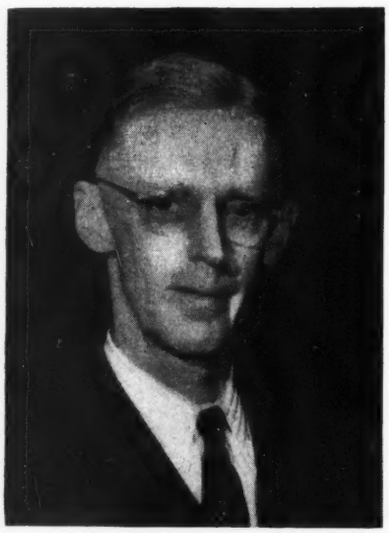
APRIL 23-26, 1951—Fifty-fifth annual convention of AMERICAN FOUNDRYMEN'S SOCIETY in Buffalo, N. Y. Secretary-treasurer, William W. Maloney, 616 S. Michigan Ave., Chicago 5, Ill.

Obituaries

Charles N. Safford

Charles N. Safford, president and director of the Lovejoy Tool Co., Springfield, Vt., died suddenly in Burlington, Vt., on July 23. Mr. Safford was born in Quechee, Vt., on September 27, 1886. After graduating from Dartmouth with the class of 1908, Mr. Safford was associated for several years with the Jones & Lamson Machine Co. of Springfield. In 1917, he became co-founder of the Lovejoy Tool Co., holding the position of treasurer until 1948, when he became president of the company.

Mr. Safford—a former representative to the Vermont legislature—had also served as chairman of the board of Vermont's Department of Social Welfare, director of the First National Bank of Springfield, vice-president of the Springfield Hospital, and was active in Chamber of Commerce affairs. He is survived by his wife and one daughter.



Charles N. Safford

Nathan Lester

Nathan Lester, president of the Lester Engineering Co. and Lester-Phoenix, Inc., Cleveland, Ohio, died of a heart attack at his home in Cleveland on June 10 at the age of sixty-six years. Mr. Lester was widely known in the die-casting and injection molding fields with which he was associated for forty years. He began his career as a toolmaker, later becoming a designer of machinery. Holding a large number of patents in the die-casting and plastics fields, he was responsible for the development of many of the techniques in use today. The companies that bear his name were organized in 1935 to design and manufacture his machines.

Nathan Lester

ARTHUR H. TIMMERMAN, retired vice-president of the Wagner Electric Corporation, St. Louis, Mo., died in Dallas, Tex., on July 18, at the age of seventy-nine. He became ill while on a vacation trip, and had been in the Dallas Hospital for several weeks prior to his death. Mr. Timmerman's industrial career began in 1899, when he joined the Wagner Electric Co. He was chief engineer from 1908 to 1919, and then became vice-president. In 1925, he was elected a director. Mr. Timmerman retired last March, after fifty years of service with the company.

* * *

No Shortage of Jobs for Engineering Graduates

According to a survey of 117 engineering colleges throughout the country conducted by the Manpower Committee of the American Society for Engineering Education, 62.5 per cent of engineering graduates this year (or four out of five) were placed by June 18, and an estimated 20 per cent more had received offers of jobs.

The report emphasizes that the anticipated shortage of jobs for engineering graduates has not materialized. "It is clear that our country can still absorb a very large number of engineering graduates," said M. M. Boring of the General Electric Co., chairman of the Manpower Survey Committee of the Engineers' Joint Council. "If we have a small enrollment in the freshmen classes entering colleges this fall, we will face a serious shortage of engineering graduates four years from now."

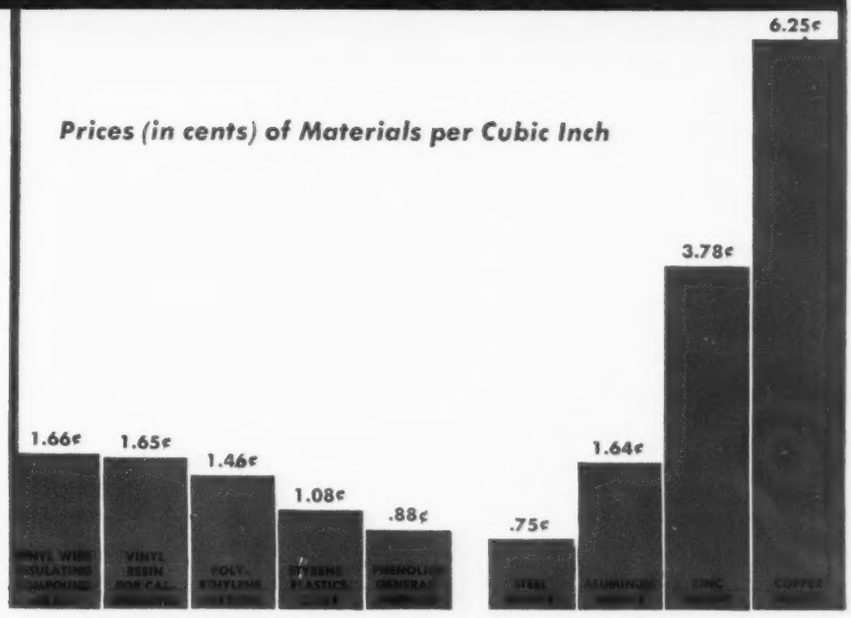
You Should Know These FACTS ABOUT PLASTICS!

PLASTICS ARE LOW-COST BASIC INDUSTRIAL MATERIALS

Most published data on plastics are written around their multitudinous uses, as industrial components and as consumer goods. Such information is of value insofar as it reveals the growing popularity and increasing acceptance of plastics.

Yet, there remains the need to clarify for management and operating executives of American business the basic reasons why plastics—in the past 10 years—have grown six-fold from a 200,000,000 to a 1,200,000,000 pound annual business.

The adjoining chart provides part of the answer. It shows the costs per cubic inch of a variety of materials including plastics and metals. Its purpose is to place plastics properly in the industrial scheme. It is not intended to draw misleading comparisons between these materials, all of which are serving industry so well and which will grow in usefulness as the national economy expands.



Specific gravity × .03605 × price per pound in cents = cents per cubic inch.
Prices in effect August 1, 1950, apply only to primary or basic materials;
Sources: "Engineering and Mining Journal," and Bakelite Division's price lists.

BAKELITE DIVISION, LEADING PRODUCER OF PLASTICS

Bakelite Division of Union Carbide and Carbon Corporation ranks as the largest producer of plastics in the world, excluding the synthetics that are not commonly regarded as plastics. While Bakelite Division does not sell all types of plastics, it does sell those that are in greatest demand such as Phenolics, Polyethylenes, Styrenes, and Vinyls.

These plastics take such forms as film and sheeting, rigid sheets, resins for coatings and adhesives, molding, calendering, and extrusion compounds, and resins developed for such industrial operations as bonding, laminating, gluing, and impregnating.

NEW USES SPUR DEMAND

There are other reasons for the phenomenal growth in the demand for plastics. Many improvements have been made in the quality and efficiency of plastics and their processing. New types and forms of plastics have resulted from the huge investment in research and development. Above all, industry has become more familiar with plastics and has learned to take the fullest advantage of their many valuable properties. Examples are given in the next column.

BAKELITE Polyethylene for blown bottles that are shatterproof, make extremely good looking, light-weight packages that save shipping costs, eliminate breakage, are squeezable for easy application of the contents.

BAKELITE Polystyrene emulsions provide the bases for wholly new types of waterproof, washable, water-thinned paints for exterior and interior service.

BAKELITE Phenolic plastics, used with Heatronic preheating are now molded in extremely large sizes... for example, one-piece television cabinets weighing twenty pounds or more.

VINYLITE plastics for electrical insulation, in distinguishing colors, are used for insulated wire, light in weight and small in diameter. They increase efficiency of wiring systems, make possible non-metallic sheath building wire.

BAKELITE Polyethylene film has become a prime medium for packaging, especially for frozen foods and produce which must reach consumers garden fresh.

BAKELITE Styrenes for wall tiles combine such desirable features as: decorators' colors, beautiful finish, lightness in weight, ease of application to a variety of wall surfaces, and low cost.

VINYLITE plastic film and sheeting has transformed a whole nation's tastes with respect to shower curtains, draperies, window shades, rainwear, and inflatables.

BAKELITE Phenolic resins are employed as the bonding media for such applications as: glass-and-mineral wool thermal insulation, abrasive products, brake linings, and foundry sand molds and cores.

BAKELITE Styrene Plastics are widely used for housewares and toys because, at low cost, they provide a high degree of serviceability, pleasing designs and gay, cheerful colors.

VINYLITE plastic flexible molding materials have provided a new concept of resilient parts for vacuum cleaners, luggage, and products such as hair curlers and dolls.

THE FUTURE FOR PLASTICS

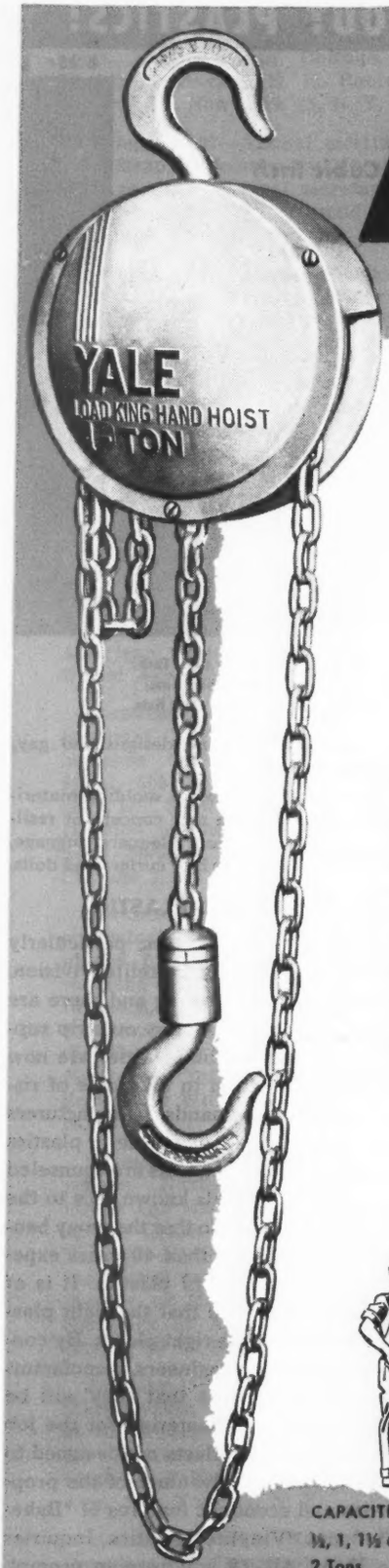
The demand for plastics, particularly the types sold by the Bakelite Division, is continually increasing and there are times when demand may outstrip supply. New production facilities are now under construction to take care of rising and future demands. Manufacturers who are considering the use of plastics to improve their products are counseled to make their needs known now to the Bakelite Division so that they may benefit from its more than 40 years experience in the field of plastics. It is of utmost importance that the right plastics be used in the right places. By consulting Bakelite engineers, manufacturers can be assured that they will be using the correct materials for the job and that their products are designed to take maximum advantage of the properties and economic features of "Bakelite" and "Vinylite" plastics. Inquiries to Dept. **AU-19** will receive prompt, thorough and confidential handling.

Bakelite
TRADE-MARK
PLASTICS
BAKELITE DIVISION
UCC

The terms "Bakelite" and "Vinylite" are registered trade-marks of

BAKELITE DIVISION, *Union Carbide and Carbon Corporation,* **30 East 42nd Street, New York 17, N. Y.**

NOW YOURS...

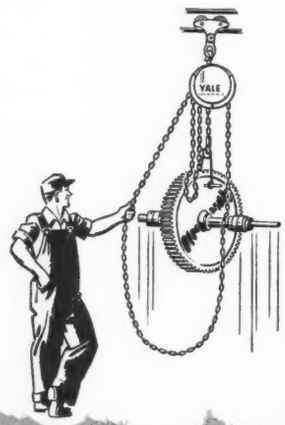


Compact... Lightweight

High strength aluminum alloy castings and alloy steels, fewer parts—these factors provide the "carry-around" lightness of the Load King. The ½-ton model weighs only 37 lbs.! Larger capacities likewise provide unusual lightness for moving the hoist job-to-job in a hurry.

Greater Efficiency

Efficiency up to 95%! It takes only 20 seconds to lift a 1000 lb. load 3 feet. In a minute, 2 tons can be lifted 2.1 feet. Such fast performance is due to minimized friction: *all* rotating shafts have ball bearings, parts are precision machined, and the powerful, revolutionary new Synchro-matic acts quick as a wink.

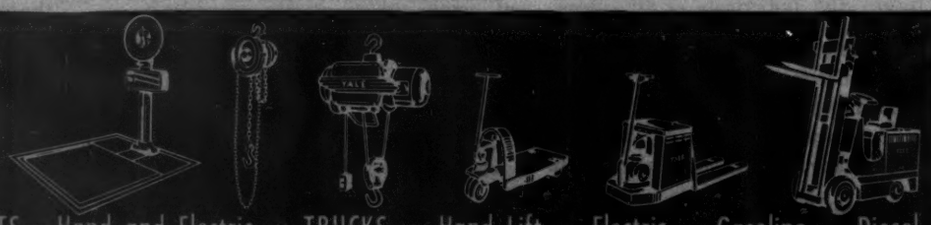


Easy on Muscles

One-half or 2-ton capacity—the Load King is a one-man hoist! Hand pull force necessary to lift the load is maintained at minimum by its high efficiency. Load King operators save energy, feel better, get more work done per hour. Hoisting costs drop.

CAPACITIES:
½, 1, 1½ and
2 Tons

YALE
TOOLS THAT KEEP INDUSTRY "ON THE MOVE"



SCALES—Industrial • HOISTS—Hand and Electric • TRUCKS—Hand Lift . . . Electric . . . Gasoline . . . Diesel